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JEJUNAL ULCER WITHOUT PREVIOUS GASTRO ENTEROSTOMY

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IN spite of the extremely active proteolysis which occurs in the upper part of the small intestine during digestion, the region of the bowel from the papilla of Vater to the end of the jejunum is under normal conditions singularly free from lesions arising in the wall of the intestinal tube. Above the papilla, the effect of acid gastric secretion is shown in the common occurrence of gastric or duodenal ulcer; below, as the ileocœcal valve is approached, ulcers from various specific causes, tuberculosis, typhoid fever, dysenteric infections, etc., become increasingly frequent. Surgical lesions of the jejunum, except in so far as they are produced by conditions affecting the intestine from without, for instance, adhesions, herniæ, trauma, the extension of new-growth from adjacent organs or unless they involve the jejunum in common with other parts of the intestinal tract, are almost sufficiently rare to be considered surgical curiosities.

The exception to this general rule at the present time is jejunal ulcer following gastro-enterostomy, which if reported cases are a measure, is probably the commonest lesion of the jejunum today. It has been estimated to occur in about 1.5 per cent of all cases in which gastro-enterostomy is performed. In these cases of jejunal ulcer we have obvious causative factors in the trauma from operation and the action of acid gastric chyme on a part of the intestinal tract normally unexposed to it. In certain cases the persistence of irritating suture material is a further predisposing cause of the jejunal or gastrojejunal ulceration. The ultimate reason, however, why a few cases should develop jejunal ulcer, in spite of all precautions of technique, while the great majority remain free, remains obscure. In recent articles upon jejunal ulcer, an occasional mention is made of the rare occurrence of spontaneous peptic ulcer of the jejunum in individuals in whom no previous operation has been performed. Van Roojen (1), in 1909, stated clearly the possibility of such a spontaneous occurrence of jejunal ulcer. He says that peptic ulcer of the jejunum, analagous to the peptic or round ulcer of the stomach or duodenum, occurs almost always following gastro-enterostomy. Three cases, however, are known to him in which peptic ulcer of the jejunum was found without having been preceded by a gastro-enterostomy. These exceptions to the general rule, not commonly recognized in modern literature, he believes of great importance, since from such cases light may be thrown on the obscure etiology of jejunal ulcer.

The importance of jejunal ulcer following gastro-enterostomy and the obscurity of its more remote causes lends to such primary ulcers of the jejunum an interest not otherwise justified by their extreme rarity. A recent case of spontaneous jejunal ulcer has led me to look through the literature. My hope was that such a review might add something of value in relation to the more common

postoperative type as suggested by Van Roojen. While this hope has not been justified, it has seemed worth while to collect and analyze reported cases of ulcer of the jejunum occurring without previous operation on the stomach. These cases have considerable interest in themselves, since they are obscure both in etiology and in diagnosis, not hard to overlook on the operating-table, dangerous to life, and yet as isolated cases not sufficiently striking to be sure of finding their way into the literature. While on one hand they approach closely in appearance and course to peptic ulcer of the stomach or duodenum, on the other, occasional instances have a resemblance to cases reported as syphilis of the small intestine. My purpose, therefore, is to gather the facts at present available concerning such jejunal ulcers, with especial reference to the recurring statement that peptic ulcer of the jejunum may occur without operation, and to consider the clinical course and etiology of these cases as far as possible from the somewhat meagre evidence at hand.

Ulcers of the intestine, of a type which shows on pathological examination no evidence of a specific causative factor, are not extremely rare in literature. Nor is the idea that such ulcers may be peptic a new one. It is, however, an assumption in regard to etiology for which the evidence is questionable. These ulcers, however, may fairly be classed in accordance with the pathological changes found, which show only a defect, with evidence of necrosis and extension or attempts at limitation and repair, accompanied by inflammatory changes usually slight in degree or by the resulting fibrous tissue. To this extent the pathological picture resembles that of ulcer of the stomach or duodenum, but this resemblance does not necessarily imply a similar etiology. The term usually used for this lesion is simple ulcer, following Cruveilhier, who first clearly described such ulcers occurring in the stomach.

Combes (2), in 1897, collected 36 cases of ulcer of the intestine, which appeared to belong to this simple pathological type. Of these, 7 involved the jejunum, 12 the ileum, 5 the cæcum, 3 the large intestine, and 3 the rectum. Leotta (3), in 1919, collected 22 cases of simple ulcer of the jejuno-ileum, including one personal case involving the ileum. The bowel affected was the jejunum 4 times, the ileum 17 times. While many of the cases reported as simple ulcer are far from conclusive in themselves, yet it remains clear, that after excluding ulceration due to known causes, such as typhoid fever, tuberculosis, new-growth, dysenteric infections, obstructive distention, etc., there remain ulcers of the small intestine, grossly and microscopically of the simple type, to which we cannot assign a definite cause.

The following case I saw in consultation with Dr. L. M. Spear, and sent to the Massachusetts General Hospital believing that his symptoms were due either to perforation of the stomach or to renal stone:

Case 1. E. S., No. 234,549, male, born in Ireland, age 47, widower. Admitted January 11, 1920, with the following history. In July, 1919, the patient had an attack of severe general abdominal pain, lasting 6 hours, during which he vomited. In September, 1919, a similar attack occurred. There were no gastric symptoms between July and September. After the second attack the patient went to the Boston Dispensary for advice, and was put on a diet which was not followed closely. Since September he has had occasional attacks of transient, but rather severe, pain localized in the left abdomen. For the past 2 weeks he has noticed that his bowel movements have been black although no medicine has been taken except epsom salts and cascara.

Yesterday the patient was seized with such severe abdominal pain in the left lower quadrant, radiating to the left flank and shoulder, that he rolled on the floor. He was given morphia and was able to sleep a little. The pain has persisted. He vomited once last night, and repeatedly this morning. His bowels moved many times yesterday but not today.

Patient has never had any gastric trouble up to July, 1919, but has always been more or less constipated, for which he took salts. There have been no cardiac or respiratory symptoms. He has had gonorrhœa several times, the last about 8 years ago when a bubo was incised in the left groin. His genito-urinary history was otherwise negative.

Patient is a well developed and nourished man, looking rather weak, evidently suffering some pain but not in shock. Examination of skin is negative. There is a scar 3 centimeters long in left groin. The pupils react to light and distance, are equal, and movement is normal. The ears and nose are negative. The mouth shows pyorrhœa and sordes. The throat, tonsils, and neck are negative. The thorax is well developed, expansion is equal, the lungs clear and resonant. The heart shows no enlargement, displacement, murmurs or thrills.

The abdomen was tympanitic throughout, the tympany extending 3 centimeters above the costal margin; the liver dullness reaching from this point to the sixth intercostal space. The patient held the abdomen tense; no masses or hernial orifices palpable. The left side was rigid, and there was tenderness about 9 centimeters below the left costal margin and in the left flank. There was spasm over this area of tenderness.

Rectal examination was negative. Reflexes were negative.

Temperature 98.8°; pulse 82; respiration 20.

White count, 18,200. Blood pressure [illegible]

Urine examination negative.

X-ray for renal or ureteral stone was negative.

Operation 3:20 p.m., January 11, 1920. Ether. Cloudy fluid was found on opening the peritoneal cavity through the upper left rectus muscle. A perforation of the stomach or duodenum was looked for, but these organs were negative. A small mass was then felt in the bowel, slightly adherent to the posterior abdominal wall, in contact with the splenic flexure. On delivery this proved to be small intestine. The induration was due to a stricture, on the anterior surface of which was a perforation 1/8 inch in diameter. At first attempt was made to close this perforation by excision and suture similar to Heinecke-Mickulicz pyloroplasty. On opening the gut, however, an annular ulcer encircled the bowel at the point of stricture, through which perforation had taken place, and the amount of constriction and induration made a plastic procedure impossible. An atypical resection was done, removing the ulcer and its margins, without the adjacent mesentery, followed by an end-to-end anastomosis. A resection of the whole loop would have proved easier. The level of the stricture was not exactly determined on account of the patient's condition. It was believed to be within 2 feet of the end of the duodenum. Closure was without drainage.

Pathological report by H. F. Hartwell. A review of the microscopic sections from the jejunum shows no evidence of syphilis. The pathological examination is therefore as follows:

A number of irregular fragments, the largest of which contains part of an ulcer in its mucosa. Its edge is slightly raised and its base is rough. At one portion of the base there is a small perforation passing directly through the wall of the gut. Its peritoneal surface is covered with plaques of fibrin.

Microscopic examination shows an ulcer, whose surface is covered with necrotic exudate. Its base is formed by fibrous tissue which extends through the entire thickness of the wall. There is considerable inflammatory exudate on the peritoneal surface. There is no evidence of tuberculosis or malignant disease.

Sections stained by Levaditi's method show no spirochæta pallida.

Diagnosis: chronic ulcer.

The patient made a good recovery without complications, and was discharged on February [illegible], 1920.

His Wassermann reaction is not recorded.

[illegible] is in medium height but pyloric end appeared further [illegible] empty in normal time. The sphincter appeared regular and the first part of the duodenum filled regularly. It appeared oblique in position as though drawn to right. The ileum was not remarkable. Bottom [illegible] only. The only abnormality noted was the position of the [illegible] of adhesions [illegible] lesion was found.

On searching through the records of the Massachusetts General Hospital, only one similar case was found. For the privilege of reporting it, I am indebted to Dr. C. A. Porter:

Case 2. W. S., 181,340, female, age 48, married, born in Russia. Admitted March [illegible], diagnosis: intestinal obstruction, peritonitis. The family history was negative for tuberculosis, [illegible] and hæmophilia.

Patient has never been in a hospital except in confinement. She has always had fair health except for constipation and stomach trouble. For years she has been subject to pain in the heart after eating and has vomited a great deal, but does not know the color of the vomitus. She has had no cardio-respiratory symptoms. The so-called pain of the heart (epigastrium) has radiated to the shoulders. She has had two children and one miscarriage. Catamenia not remarkable.

Patient has been indisposed for about 7 weeks. A week ago she began to have severe pain about the heart and vomited "awful." Since that time she has been in bed and has vomited occasionally every day. Her bowels have moved with small result. She has seen nothing remarkable in the stool, and has noted no blood in the vomitus. Repeated enemas have failed to give anything like good results. A note from her doctor states that she began to have severe abdominal pain this morning and repeated attempts failed to move the bowels.

Physical examination showed a well-developed and stout Jewish woman, lying in evident distress. The pupils react. The tongue is coated; the mouth otherwise negative. Examination of chest shows hyperresonant note. The breath sounds are clear except at base where there were numerous deep râles. The heart is not enlarged; sounds regular, fair quality, clear. The abdomen is full, rather distended but not rigid. There were numerous blistered areas over epigastrium, the result of turpentine stupes. No masses are palpable, but tenderness is present through the whole abdomen, more particularly in the epigastrium. No visible peristalsis is observed.

[illegible] shows nothing except increased abdominal tenderness

[illegible] no evidence

Temperature 98°; pulse, 112; white count, 10,000.

[illegible] *Ether*. On median suprapubic incision, thin, cloudy fluid and fibrin flakes without odor were found. Intestines were distended and injected. Exploration shows a mass in the right upper quadrant. A transverse 5-inch incision was then made along the right costal margin. The tumor was brought into [illegible] found to be a loop of jejunum 6 inches long, twisted, and kinked, and bound down by adhesions. On freeing the adhesions, fæcal matter escaped from a perforation in the gut. No attempt was made to locate the portion of gut which was involved, but it seemed to be the middle of the jejunum. The bowel on one side of the kink was collapsed, on the other distended. A loop, 6 inches in length, was resected and an end-to-end anastomosis done with Pagenstecker. The transverse incision was closed with drainage of the superficial fascia. A rubber tube was left in the pelvic wound.

Pathological report. The specimen is a piece of intestine 15 centimeters long. The serous surface is injected and covered with fibrin. Section shows the walls and mucosa considerably darkened with a soft, moist appearance. A ragged, circular perforation through all coats 1½ centimeters in diameter is present in one extremity of the gut. The intestine on one side of the ulceration 8½ centimeters, on the other side 2½ centimeters in transverse diameter.

Microscopic examination of the edge of the ulcer showed a little granulation tissue but no evidence of any new-growth. The blood vessels in the immediate vicinity were not especially altered or thrombosed.

Diagnosis: Simple ulcer.

Discharged, March 23, 1912.

In neither case was the level of the lesion exactly determined. It seems fair, however, if the ordinary arrangement of the intestinal coils held good in these instances, to accept the operative diagnosis of ulcer of the jejunum level undetermined, although in Case 1 the loop involved was probably not far below the end of the duodenum. In neither case is the Wassermann reaction known, although syphilitic exposure would seem probable in Case 1, on account of the repeated attacks of gonorrhœa. Sections of the ulcer, however, were negative for spirochæta pallida by the Levaditi method. There was nothing suggestive of tuberculosis on microscopic examination in either case. Each presents a chronic ulcer of the jejunum which cannot be assigned to the usual causes of intestinal ulceration. In their pathological findings, chronicity, induration, tendency to cicatricial contraction, and ultimate perforation, they have much in common with peptic ulcer of the stomach or duodenum.

The records of 4,200 autopsies in the Pathological Department of the Massachusetts General Hospital, examined by permission of the director, Dr. J. H. Wright, shows no case directly comparable to the above. Further evidence, therefore, depends upon the literature. I have been able to find the following cases, nearly all incomplete in various respects, abstracts of which I present at this point, in order to facilitate a discussion of the general aspects of jejunal ulcer arising without operative interference. Cases from the older literature have been included, since the total number is so few.

Case 3. Reported by Wagner (4), in 1858. A laborer of 18 was buried up to the lower chest by a fall of earth. He gave evidence of peritonitis and died 22 hours later. Autopsy showed diffuse peritonitis. The mucosa of the stomach and duodenum was normal. After freeing omental adhesions, on the surface of the jejunum, opposite the mesentery, 6 inches from the end of the duodenum, an oval hole was found, from which intestinal contents flowed. The adjacent mucosa showed normal microscopic structures. The remaining intestine showed no ulceration. A reconstruction of the anatomical changes is most probably as follows: a chronic ulcer of the upper jejunum gradually consuming all layers was hindered, at least temporarily, from perforation by adhesions of the omentum. As a result of burying, the omental adhesion was separated. The jejunal ulcer had the greatest similarity with the so-called perforating or simple chronic ulcer of the stomach, and is to the same, at all events, analogous.

Case 4. Reported by Taylor (5), in 1865. A man, age 45, given to drinking, who after drinking beer freely and being thrown in a wrestling match complained of having strained himself in the abdomen. He walked home, a distance of a mile, and complained of intense pain from time to time until his death, which took place 50 hours after the accident. The postmortem showed evidence of a severe peritonitis, and a small aperture, which would not admit a pin-head, was found in the jejunum. This aperture seemed to have been the result of an ulcer, which had commenced on the outer surface of the intestine.

Case 5. Reported by Perroud in 1866 (abstract from Combes (2). A cooper, 32 years old, in good general health, suffered for 3 months from slight dyspepsia. While at stool he felt a violent colic, soon followed by three periods of syncope. The pain continued; symptoms of peritonitis and obstruction developed, death occurring about 36 hours after onset. Autopsy showed acute diffuse peritonitis. No

intestinal obstruction. [illegible]; but in the right hypochondrium in a loop of small intestine near the end of the duodenum, a small rounded opening was demonstrated the size of a lentil, situated at the level of the mesenteric insertion, communicating with the interior of the intestine, and explaining the presence of gas and fæces in the peritoneal cavity, as well as the acute peritonitis. The walls of the intestine, in the neighborhood of the perforation were red, a little thickened, and much softened. The remainder of the digestive tube was entirely sound. No alteration was found in the other organs. Tubercles were no where in evidence.

This case appears to be an example of simple ulceration of the small intestine, which one can compare with those ulcerations of the stomach which develop without much inflammation, and which only show themselves during life by very slight symptoms of dyspepsia

The author does not state definitely whether the perforation was above or below the end of the duodenum. From the terms of the description, and the presence of fæcal matter in the abdominal cavity, it seems probable that the jejunum was involved.

Case 6. Reported by Reverdin (6), in 1867. A man of 55, of alcoholic habits, died after 2 days of vomiting and obstipation. Autopsy showed evidence of peritonitis. On the right, halfway between the iliac crest and the liver, was an intestinal perforation. The stomach and duodenum were slightly dilated presented no alteration of their mucosa. The mucosa of the intestine was normal throughout, except at the level of the perforation. The latter was situated on the free border of the intestine, at the level of the middle part of the jejunum. It was almost round, the size of a 50-centime piece. Its margins, shaped as by a punch, were a little thick, and turned back from the serous side. No foreign body was present in the intestine. The remaining organs were essentially negative. No lesion of the abdominal aorta was present.

Case 7. Reported by Simpson [illegible] A man of 56, by trade a maltster, whose mental condition at death was one of dementia consecutive to chronic mania, collapsed and died suddenly. He was accustomed to devour filth and rubbish of all sorts. He had complained only of slight pain and constipation. Autopsy showed no marks of injury. The peritoneal cavity contained about 30 ounces of blood-stained serum, but no fæcal matter. The mucous membrane of the alimentary canal was normal, except at a point 6 inches below the beginning of the jejunum, where there was a single ulcer about 6 millimeters in diameter, irregularly circular in outline and with clean-cut edges which showed no signs of chronicity, perforating through all its coats. A few shreds of wood fiber were the only foreign bodies in the alimentary tract, and no extraneous substance was discovered in the peritoneal cavity. The gall [illegible] showed hypertrophy and dilatation; there was well-marked degeneration of the myocardium: the [illegible] valves were somewhat thickened. Both kidneys [illegible] nephritis.

The [illegible] presence being the [illegible] ulcer and the [illegible] which after [illegible] scalds, but there seems a possibility that it may have originated by [illegible] foreign body introduced by the mouth.

Case 8. Reported in Brit. M. J., 1906, i, [illegible] medico-legal case. A man of 57 who had been under treatment for heart disease, hydrocele and stricture, on the morning of February 10, while carrying a tray and passing through a door, ran against the [illegible] hurting himself. He died suddenly at 1 a.m., Feb [illegible]. At the post-mortem [illegible] was seen in the left groin and a slight bruise on the internal abdominal wall corresponding with the bruise on the surface. The [illegible] about a foot from the spot where the ulcer of the intestine had ruptured. Death proved [illegible] of a small chronic ulcer of the small intestine, 8 feet from the stomach, through which [illegible] fæcal matter had percolated, and there were signs of commencing peritonitis.

Case 9. Schmilinski (8), in 1910, reported a case of stenosing ulcer of the jejunum. The patient, a woman of 63, had for years pain in the stomach, with on two occasions vomiting of blood and melæna. Findings, 3 years ago, obstructive incompetence of stomach with residue; hypersecretion. Diagnosis: stenosing ulcer of the pylorus or duodenum. Until January, 1909, she was free from pain by means of diet and lavage, when a recurrence of the pain developed. In the fasting contents, no free hydrochloric acid was found, instead of which was an admixture of bile. Air blown into the stomach emptied itself into the duodenum remarkably quickly for a pyloric stenosis.

At operation the duodenum and beginning of the jejunum were found dilated. Four centimeters below the duodenojejunal fold was a stenosing induration of the jejunum and adjacent mesentery. Resection; recovery. The specimen showed on the mesenteric border of the stenosis a small ulcer, which, as well as its surroundings, showed microscopically the [illegible]

In the discussion, Fraenkel had observed a similar case, in which he arrived at a diagnosis of syphilis by means of staining the elastic tissues. Again, in a case of phthisis, he found a stricturing ulcer at this point. The present case appeared to him syphilitic. Katz raised the question whether at the examination of the patient 3 years previously, a pyloric in-

competence might not have already existed. In this case it was possible that as a result of the existing hypersecretion a peptic ulcer might have developed, which had led to a stenosis.

Schmilinski, in closing, said that at the previous examination, whether or not the pylorus was capable of closing was not determined. The previous statements gave great weight to the acceptance of a syphilitic etiology for the ulcer. The elastic fibers were not investigated. The remaining findings gave nothing of note either for syphilis or for tuberculosis.

CASE 10. Cade (9), in 1913, reported the case of a man, age 25, a grocer clerk; who entered hospital [illegible] died June 4, 1911. His health was habitually good. He denies excessive drinking and syphilis. A month ago, he had moderately severe pain in the left iliac fossa, relieved by medicine, so that he was able to continue his work. Ten days ago the pain returned. A large mass was found at this time in the left iliac fossa. He then improved somewhat and was able to come on foot to the hospital. At 8 p.m., shortly after his arrival, he felt a violent, stabbing pain in the lower abdomen. Copious vomiting, complete obstipation, hiccough and the development of great distention ensued. Collapse and death occurred the next morning. Autopsy showed the abdomen full of pus. In the left iliac fossa the intestine presented a perforation; pressure forced out the contents. The perforation was situated in a loop of small intestine adherent to the pelvic colon. On dissecting the intestine, nothing abnormal was found in the large intestine or appendix. In the small intestine, about 60 centimeters below the duodenum, the affected loop was found. At this point there was a thick, circular zone formed of fibrous tissue, about 1 centimeter in breadth, which, however, did not cause a stenosis. Immediately above this zone there was a blackish, necrotic area, and it was at the middle of this that the perforation was situated, about 5 millimeters in diameter, with ragged edges. The remaining small intestines were negative, as were the kidneys, heart, and lungs. Many mesenteric glands were hypertrophied. Microscopic examination of the edge of the ulceration showed thickening of the intestinal wall, inflammatory infiltration, and necrosis of the mucosa. No change was found suggestive of tuberculosis. A section of the mesentery showed the vessels permeable; of a mesenteric gland, recent inflammatory changes.

CASE 11. Murphy (10) reports the case of ulcer of the duodenum and jejunum. The patient, a man of 62, whose family and past histories were negative, had suffered for 15 years with digestive disturbances, worse during the past 4 years, with a tendency to periodic attacks, about once a month. The principal symptoms have been pain in the epigastrium, and vomiting. Six weeks ago, there was evidence of near perforation in the upper abdomen [illegible] by abdominal soreness and tarry stools. A few days later hæmatemesis occurred. Roentgenograms revealed obstruction to the outlet of the stomach and involvement of the gall bladder. The diagnosis was duodenal ulcer with attempts at perforation and sequential adhesions.

Operation: "As we explore the upper abdomen, we find the gall bladder empties itself easily, but is adherent to the duodenum. The upper surface of the arch of the duodenum is involved in an extensive inflammatory induration which indicates the site of a duodenal ulcer. . . . There is another ulcer in the first part of the jejunum. This is but the second ulcer I have seen in this situation."

Anterior gastro-enterostomy was performed. The patient was reported as much improved 3 months later.

CASE 12. Bryan (11), in 1916, reports the case of a man, age 48, who 25 years previously had typhoid fever, and 2 years later a mastoiditis, which resulted in unilateral deafness and a sinus still persisting. He never drank or used tobacco. In the last 4 years he has had severe attacks of indigestion with increasing frequency of late, characterized by violent cramps in the region of the stomach. Two years ago he had constant pain and nausea, which continued for 4 months. He vomited constantly, but never noticed any blood. A diagnosis of ulcer of the stomach was made. The pain and nausea, although somewhat relieved by gastric lavage, have persisted, so that he has been unable to do any regular work for three years. September 8, 1915, at 11 a.m., he was seized with agonizing pain in the abdomen and groin. At 8 a.m. the picture was that of acute abdomen and the diagnosis of probable perforation of ulcer of the stomach was made. Operation was refused until 8 p.m. The peritoneal cavity was full of greenish fluid with flakes. The stomach was atrophic, hard, bound down, pulled to the left, and firm, the walls white and heavy, the omentum shrunken and thick. The duodenum was plastered down, the jejunal wall was likewise indurated, whitish, and thickened; and on its anterior wall, about 3 inches from the duodenojejunal junction, a round, punched-out ulcer, the size of a cherry stone was found. The induration of the jejunum extended several inches below the point of perforation and tapered off gradually in the jejunal wall. Closure of the perforation with omentum. Death. No autopsy.

These cases, with the two reported in this paper, make the whole basis, so far as I have been able to find it, for a discussion of the spontaneous occurrence of peptic ulcer in the jejunum. Some of the cases are so incomplete as to be practically worthless, yet as a whole they form a clinical group with a good deal in common and as far as the evidence goes, seem to be instances of simple ulcer. My aim has

been to be inclusive rather than critical. Only one case is confirmed both by microscopic examination and autopsy, only three others by microscopic examination and of the six remaining autopsies, several are very briefly reported.

Of the 12 cases, [illegible] of 45 and 63, and [illegible] autopsies in which the condition of the whole bowel is mentioned, the jejunal ulcer was the only one present in the intestinal tract, excluding for these cases a general ulcerative process. In the remaining cases, only one intestinal ulcer was actually demonstrated although more might exist. In 6 cases, confirmed five times by autopsy, and once, in my own case, by operative evidence and X-ray, the stomach and duodenum were apparently negative. Two cases, those of Murphy and Bryan, showed a lesion of the duodenum or stomach. In four cases the condition of these organs is uncertain. The most frequent situation for the ulcer was within a few inches of the end of the duodenum, occurring there five times. The other ulcers lay between this point and the middle of the jejunum, or possibly lower. The ulcer in 7 cases showed evidence of chronicity, and was associated three times with a definite stricture of the bowel. In 2 cases the ulcer seemed acute, in the remaining case the point is not clear. Perforation occurred ten times in the 12 cases.

Description of the ulcer itself is rather vague. Three times its general resemblance to ulcer of the stomach is noted, twice more its punched-out character is mentioned. Only once was it apparently annular; in general it appeared to affect a limited part of the bowel circumference. In the 3 cases with constriction of the bowel it is hard to say whether the constriction was the effect or the cause of the ulcer, although the former seems to be the case. In 1 case (Cade) the perforation took place above a zone of fibrous tissue in the intestine.

The microscopic examination in 2 cases showed the changes associated with simple ulcer, without evidence pointing toward a definite cause, infectious or otherwise. In only 1 case did this examination include the mesenteric glands which showed only inflam-

[illegible] negative value in excluding tuberculosis, but are of little positive help in connection with [illegible] use of the ulcers. One case examined by the Levaditi method showed no spirochæta pallida. In no case is the Wassermann reaction known.

Since some of these ulcers are definitely chronic in course, it is conceivable that they might prove a starting point for the rare cases of cancer of the jejunum. I am unable to find evidence for this point. Herzog (12) reports a case in which two primary cancers, one of the ileum and one of the ileocæcal valve, developed on the site of old tubercular ulcers.

Little ground exists for a discussion of the etiology of these ulcers either as a group or as individual cases. In two cases alcoholism, in one chronic dementia, filthy habits of eating, and interstitial nephritis, in another stricture of the urethra and heart disease, may be contributing factors; they hardly suffice as a complete explanation for the occurrence of the jejunal ulcer. In one case (Schmilinski) syphilis might have been an adequate cause. But as a whole we can only say that there are certain types of intestinal ulceration to which the majority at least of these cases do not belong. Ulcers of a dysenteric nature may be excluded, since such cases would show a diffuse ulcerative process lower down in the intestinal tract, a condition excluded by the cases coming to autopsy, and not suggested by the clinical history or operative findings in the remaining cases. Nor is it likely that these cases, with as far as known a single destructive lesion high in the intestinal tract, belong to the rather indefinite groups of catarrhal, follicular, and toxæmic intestinal ulceration. Further the evidence does not favor a recent gross embolism or thrombosis.

Active typhoid fever may be excluded as a cause. While typhoid ulcers may involve the jejunum, and even perforate it, they are rare at this level. Further, typhoid ulcers usually heal without cicatricial contraction, and would be unlikely to leave an area of lowered resistance in the jejunum.

Instances of perforation of the small bowel due to stasis and distention above an obstruction [illegible] Such cases have not been

included when recognized since the cause of the ulceration seemed definite. In Case 2 this cause should be considered but here the ulcer occurred at the point of greatest constriction, and not above it. In Cade's case, where the perforation took place above a zone of fibrous tissue, there was no stenosis.

Strangulation of the bowel may lead to cicatricial stenosis. Intestinal ulceration and perforation may occur above or at such a stricture. Sestier (13) in 1827 reported a case of perforation of the jejunum occurring from this cause following a successful operation for strangulated hernia. Meyer (14) has shown that a stenosis persisting after strangulation of the bowel is not necessarily double, although the intestine is commonly constricted at two points. In a review of the literature he found that a stenosis might develop either from the whole incarcerated loop, forming a relatively long narrowing, or only from the parts of the loop of bowel actually constricted by the hernial ring. In the latter case, single and double narrow stenosis were reported in the literature with equal frequency. There is no reason for suspecting a stricture due to previous strangulation as the cause of jejunal ulcer in the present series of cases; it must, however, be considered a possibility.

Active tuberculosis as a cause of the ulcers seems improbable, since in most cases it would be recognizable on gross examination. Tuberculosis of the jejunum alone is rare. In 49 cases of tubercular ulcers of the small intestine, found among 4,200 autopsies at the Massachusetts General Hospital, the ileum was involved 43 times, the jejunum and ileum 5 times. One child of 2, dying of generalized tuberculosis, showed a few groups of non-ulcerated tubercles in the jejunum only. Gross perforation of the ileum into the peritoneal cavity occurred 3 times. The fact that perforation of a tubercular ulcer is unusual, occurring in only from 1 to 5 per cent of all cases, according to Cruice (15), is hardly an argument against tuberculosis in such a rare lesion as the one under discussion.

In the case of a healed or nearly healed tubercular lesion of the intestine, resulting in a stricture or an area of lowered resistance, the primary cause might not be found on gross examination, and might even be overlooked microscopically, if the mesenteric lymph glands were not examined. Yet such an area might be subject to secondary ulceration from sepsis or irritation. That this is possible is shown by a case of Lazerevic (16), where a stenosing chronic ulcer of the jejunum led to diffuse peritonitis, the tubercular nature of the lesion becoming apparent on microscopic examination. It is undeniable that some of these jejunal ulcers may have been tubercular in the beginning, but this does not satisfactorily explain the group as a whole, particularly since the cases coming to autopsy do not record tuberculosis in other organs.

The surgical importance of syphilis of the stomach is well recognized. It is less generally appreciated that syphilis of the small intestine may cause surgical lesions. Both congenital and acquired syphilis may affect the small intestine. The former is less rare, being observed at autopsy in infants dying of hereditary syphilis, and is not of immediate importance. Obendorfer (17) in 1900 collected 24 cases of acquired syphilis of the intestine, in 5 cases associated with syphilis of the stomach. The small intestine was affected in 18 cases, in half of which the jejunum or jejunum and ileum were involved. Perforation occurred twice. Weiss (18), in 1902, found that perforation occurred seven times in 35 cases of syphilis of the intestine. Fraenckel (19), in 1910, reported 3 cases of acquired syphilis of the small intestine, situated twice in the jejunum and once in the ileum, the only ones observed in a material of about 19,000 autopsies. He adds 4 other cases of possible syphilis of the small intestine occurring in the literature since 1900. He believes that there has been much confusion in the past between tuberculosis and syphilis of the intestine. Even admitting that many of the cases previously described as syphilis may have been partly healed tuberculosis, or intestinal ulcers or strictures due to other causes, the occurrence of syphilitic ulcers and strictures of the small intestine seems certain. The presence of spirochæta pallida has been shown in acquired syphilis of the small intestine by Arkin (20) and in congenital syphilis by various observers.

MacCallum (21) describes the lesion of acquired syphilis as follows: "Tertiary lesions of the small intestine are usually localized in the jejunum, where they appear as flat elevations of the character of syphilitic granulation tissue involving mucosa and submucosa. Multiple ulcers are formed, which extend in the forms of rings around the gut and which in healing may produce strictures."

The proof that a lesion of the small intestine is syphilitic is not easy. It may be suggested clinically by the history, by the effect of antisyphilitic treatment, or by the Wassermann reaction. The gross appearance of the intestinal lesion may be suggestive and may be supported by syphilitic lesions in other organs. Similarly the microscopic examination may be strongly suggestive of syphilis, particularly in the presence of endophlebitis and endarteritis with gummatous infiltration. But there is no conclusive point by which the nature of the syphilitic lesion may be recognized in all its stages unless the spirochæta pallida is demonstrated in the lesion. Conversely, the exclusion of syphilis as a cause of intestinal ulceration is correspondingly difficult.

For a consideration of syphilis, the evidence in the present series of cases is lacking. It is true that in no case except Schmilinski's there is a history suggesting syphilis, but in no case is the Wassermann reaction known. The gross lesion described as syphilis of the small intestine, girdle-like constricting ulcers, usually multiple, occasionally with diffuse infiltration of the bowel wall, do not correspond with the lesion described in these cases, with the possible exception of Case 1, Schmilinski's and Bryan's. We can only say that syphilis produces a type of ulceration, leading to stenosis and occasionally to perforation which in contradistinction to other types of intestinal ulceration, affects the jejunum more frequently than other parts of the small intestine, and thus forms an exception to the general rule of the higher resistance of the jejunum to pathological changes. Whether some of the cases included as simple ulcer of the jejunum are syphilitic in origin can not be stated.

It is only after the exclusion of the causes previously mentioned that the question whether these ulcers of the jejunum should be classed as peptic ul[illegible]

I take peptic ulcer to mean, in the usual clinical sense, an ulcer in the p[illegible] formation being not yet entirely clear. In the [illegible]s in which the ulcer occurred close to the end of the duodenum, it is possible that the acid gastric juice may have been a [illegible] stomach or duodenum, the ulcer was in this [illegible] interference with pyloric control, through [illegible] tricial involvement or otherwise, might permit [illegible] fashion that neutralization in the duodenum did not occur. In the cases without a [illegible] near the pylorus, persistence of the gastric acidity in the jejunum is harder to imagine. [illegible] the jejunum, their position alone would [illegible] to exclude acidity as a possible factor.

To explain ulcers lower in the jejunum, the question of a digestive ulcer from alkaline [illegible] dition is conceivable, particularly secondary to a pre-existing lesion, the mass of clinical experience is against this assumption and it can only be considered a possibility for [illegible] confirmatory evidence is lacking. It [illegible] clear, however, that these jejunal ulcers [illegible] whole cannot be classed as peptic ulcers in the usual clinical sense.

The etiology of these [illegible] mains in doubt. Nor is it at all clear that they should be considered a group with a common cause. Their clinical resemblance may well be [illegible] ogy. The usual clinical course is a sudden peritonitis from perforation without previous warning, as occurred six times, associated in [illegible] one case perforation followed a definite attack of localizing peritonitis. Four cases gave upper abdominal symptoms more or less suggesting gastric or duodenal ulcer. In two these a definite gastric or duodenal [illegible] existed. One case only gave symptoms which might suggest the lesion. Here the symp[illegible] suggested pyloric obstruction, but air blown into the stomach emptied itself into the [illegible]

denum remarkably quickly, and bile was found in the fasting contents, thus suggesting an obstruction below the duodenal papilla. The only possibility of diagnosis previous to perforation would appear to depend on the demonstration of a jejunal stenosis by clinical or X-ray evidence.

Five cases were operated on; in [illegible] the jejunal ulcer was found; in [illegible] a gastro-enterostomy was done for associated duodenal ulcer; these cases recovered. One case of advanced peritonitis with closure of the perforation with omentum died. The remaining cases died without operative interference. The operation of choice, on account of the danger of perforation, appears to be resection of the bowel or possibly excision of the ulcer. Short-circuiting, by gastro-enterostomy, or otherwise, may be necessary for a stenosing ulcer, in which resection is not possible, or when there is associated disease of the stomach or duodenum. In desperate cases, closure of the perforation, by the means most readily available, is the obvious course.

To sum up, the literature gives evidence of the rare occurrence of jejunal ulcer apparently of simple type, resembling somewhat peptic ulcer of the stomach or duodenum, and having a similar tendency to perforation and occasionally to cicatricial stenosis. No sharp line can be drawn between these simple ulcers of the jejunum, and similar ulcers occurring lower in the small intestine. While for the purposes of this paper jejunal ulcers only have been considered, it would seem more rational to discuss as one inclusive group, simple ulcers of the jejuno-ileum. Whether these represent a clinical entity, or are merely the odds and ends of various pathological processes, can not be asserted.

The two cases of jejunal ulcer reported in this paper appear to be instances of simple ulcers affecting the jejunum. Such ulcers occur chiefly in males beyond middle life. No definite etiology may be assigned to them. It is possible that in so rare a condition there may be almost as many causes as cases. In the cases where jejunal ulceration occurs close to the end of the duodenum, it is possible that disturbance of pyloric control may lead to gastric contents reaching the jejunum without neutralization, and so to the formation of true peptic ulcer. For ulcers situated lower in the intestinal tract, this cause seems improbable. Since syphilis produces a form of intestinal ulceration which affects the jejunum more readily than the ileum, and also has a tendency to cicatricial contraction and perforation, it must be considered as a possible cause of ulceration in some of these cases, although definite confirmatory evidence is lacking. Two points are of particular importance in future cases: a careful microscopic study of the lesions, including if possible the mesenteric lymph nodes, and the determination of the presence or absence of syphilis. Whatever the cause, the occurrence of perforation gives these ulcers a definite surgical importance, the more so since the perforation does not take place in one of the regions in which we are accustomed to search for it. The present summary is merely offered to call attention to this type of ulcer and the possible relation of some of these cases to syphilis of the small intestine.

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THE SURGICAL TREATMENT OF PERFORATED ULCERS OF THE STOMACH AND DUODENUM

By [illegible]

SINCE the time of Mikulicz perforation of a gastric or duodenal ulcer has been an indication for laparotomy. The several methods practised have had but one purpose—closure of the perforation. One was content with this simple procedure, which consisted in suturing, covering the defect with omentum, and fixing the ulcer to the anterior abdominal wall. The operator did not do more than excise the ulcer, for he did not trust himself to carry out a more radical measure. Kausch, even as late as 1913, distinctly warned against a more radical operation. To my recollection, Haberer, in 1919, was the first to report successful resections in cases of perforated ulcer of the stomach. Haberer was followed by Eunicke and Massari, who reported similar cases. The first complete resections were carried out, in 1920, by Schwarzmann of our division. He reported 9 cases of resection of the stomach, 8 of which resulted in cures. Since then only 6 cases have appeared in the literature. One was reported by Henry, of the Montreal General Hospital, in SURGERY, GYNECOLOGY AND OBSTETRICS, 1921, xxxii. Henry described a case of recurring perforation. His article has prompted me to report our conclusions which are based on an enlarged experience in treating, by means of resection, perforated gastric and duodenal ulcer.

One advantage of the conservative methods is that the operation consumes only a short time. On the other hand, prognosis can only be indefinite for such methods do not remove the ulcer. By means of gastro-enterostomy, however, one endeavors at least to heal. Does this really help the patient?

At the surgical congress in 1905, reports from many sources were made, to the effect that gastro-enterostomy did not always yield functional results. After operation one observed at first a disappearance of the complaints due to the ulcer, a lowering of the hyperacidity, [illegible] —but this was not true in all cases, for there began to appear recurrences in considerable number. [illegible] gested to take the place of gastro-enterostomy. Experiments have been made on animals to determine the value of the operation and it has been found (Kelling, Cannon, and Blake) that in a patent pylorus the larger amount of stomach contents goes through the pylorus and not through the anastomotic opening, no matter whether the opening is in the antrum or in the fundus. It has also been noted that there is scarcely any appreciable difference in the emptying time. This has been verified by repeated X-ray examinations of patients who have had gastro-enterostomy as before, the stomach contents passes through the pylorus. For this reason it has been taken for granted that the gastro-enterostomy has become closed. However, Schnitzler has shown that a correctly performed gastro-enterostomy cannot close, as the opening is completely covered with mucosa; that is, the opening can only become narrow when the technique is incorrectly carried out—for instance, the opening may be made too small or the mucosa may not be painstakingly sutured. In fact one frequently finds, on opening up a patient on whom a gastro-enterostomy has been done, that the old gastrojejunal fistula is entirely patent although the pylorus offers no hindrance. Technical failures that appear after months or years should be excluded as they could have been felt a short time after operation.

After all, more stress should be placed upon the unfinished methods. Gastro-enterostomy is performed with the idea of deflecting from the ulcerated area the pepsin and acid-containing stomach contents. It is not understood just how this is accomplished in the ulcer-free pylorus, for we know that the stomach contents still go through the pylorus and that the mechanical change is produced only when

there is complete pyloric stenosis, in which case the stomach contents must go through the new passage. Therefore, a great many surgeons have decided that gastro-enterostomy does not offer complete cure for ulcer. It has been stated that the change in the chemistry of the contents of the stomach brought about through a gastro-enterostomy does have a healing action as far as the ulcer is concerned. Indeed, through the back current of the alkaline jejunal content, the salt acidity of the stomach is neutralized and so loses its destroying action. This would happen only when the stomach is so completely filled that its contents come in contact with every part of the stomach wall and would be permanent only if the secretion were neutralized. It is true that the stomach contents come in contact only with the part nearest the anastomosis. However, to heal an ulcer by a change in the chemistry it must be more energetic than is possible in the immediate vicinity of the anastomosis. Schnitzler calls attention to the experiments of Pavlow who found that switching the direction of the pulp did not noticeably reduce the secretion in that portion of the stomach. He disregards the fact that there is active stomach secretion by the false lining and that even jejunostomy apparently cannot interfere with the secretory action of the mucosa to such an extent that in every case the ulcer is healed. There must then certainly exist a disproportion between the power of secretion of the stomach glands and that of the intestines with their small irregular supply of alkaline intestinal juice. We know, however, that the internally produced acidation of the stomach produces only subjective relief, as no real clinical or roentgenological cure is effected. Therefore, it is evident that gastro-enterostomy offers only relative rest to an already existing or a future pyloric stenosis and that only in a mechanical way. It can in no way serve as an absolute means of curing a gastroduodenal ulcer. The ulcer still exists and therefore there is the danger of hæmorrhage and perforation, as Schnitzler with the material collected up to 1914 showed. Indeed, the danger is doubled through the appearance of peptic ulcer of the jejunum which requires more skillful handling. Since Braun, in 1899, described the first of such cases, there has appeared the reports of many cases of this dreaded complication following gastro-enterostomy and this has naturally resulted in a loss in popularity of the operation even with those who received so enthusiastically the pyloric deflection as advocated by von Eiselsberg.

It was realized that a more radical means must be found to relieve ulcer of the stomach and duodenum, and resection was decided upon as a more effective means of dealing with the condition. The technique of resection has been perfected to such an extent that at present the method can be depended upon, and the mortality is proportionately low.

In 1914, Schnitzler described the technique of extensive stomach resection for ulcer. By this method only can the secretion of the mucosa be greatly limited. He believes that gastro-enterostomy is indicated only in stenosis of the pylorus with healed ulcer. While radical resection is carried out only in uncomplicated ulcer, one hesitates at times before attempting a palliative operation in perforated ulcer. Apparently one hesitates to begin so difficult a task and prefers to use the old method although it is quite clear that it is not satisfactory. The patient who has but recently recovered from peritonitis due to perforation is placed in a new danger and he still carries the burden of the same difficulty from which he has so long suffered and which has weakened him. How true this is is shown by a case reported by Henry. His patient, in a period of 4 years, was laparotomized for ulcer of the stomach not less than five times, that is for peptic ulcer of the jejunum after gastro-enterostomy. In this case the patient could have been relieved by resection without so many operations. But how many times this has happened, and how many such cases are never reported!

We believe that simple excision of the ulcer is not sufficient, since it does not bring about the most important condition for cure, that is limitation of secretion. If the ulcer has not perforated, resection does give a satisfactory result. (By satisfactory we mean a lasting freedom from recurrence, controlled clinically and roentgenologically.)

From our experience, we have, therefore concluded that in perforated ulcer the radical operation is the method of choice if we wish to save the patient from a long-continued illness, for in the end we would be compelled to do the more radical operation, provided the patient has not already succumbed from bleeding or further perforation, and we would then have adhesions to deal with.

The question arises, can resection be done in case the ulcer has perforated? A glance at the case reports will answer the question. We have reported 19 cases, of which 14 were cured and 5 died. All of these cases were admitted to the hospital showing clinically widespread, acute peritonitis.

In all of the cases, the cause of illness was diagnosed, before operation, as perforation of the stomach or duodenum due to an ulcer. In only 4 cases was an iliocæcal incision made, as the history was very hazy and the point of greatest tenderness lay in the cæcal region. It was easy to diagnose perforation because of the quantity of exudate in the abdominal cavity. In these cases two drains were placed through the iliocæcal incision into the pouch of Douglas, and a median incision was made in the epigastric region. In all the cases perforation was into the abdominal cavity. There was a diffuse, purulent peritonitis, and much gas, exudate, and gastric and duodenal contents, in the abdominal cavity.

In all cases resection of the stomach was done, and more than two-thirds of the stomach was removed, in two cases following the Billroth method and in the rest the Kroenlein-Mikulicz method. The duration of time between perforation and operation was from 1¼ to 36 hours. All patients were given as little anæsthetic as possible, morphine and ether being used. All other details —history, condition of patient, findings at operation, condition after operation, and re-examination —are mentioned in the report of cases. It is noticeable that the ages ranged from 24 to 56 years and that the patients came from all walks of life which has a bearing on the general state of the patient nourishment and strength.

It will be noted that the cases in which a good prognosis could be made were treated by non-radical resection, within the first 12 hours after perforation. Up to this time the patients withstand the radical operation very well, provided the operation is carried out under favorable circumstances, by which we mean that the surgeon grasps the situation quickly, employs good technique, and the patient is given but light anæsthesia. Local anæsthesia has no advantage. According to Schnitzler, except for the severe septic condition of the patient, meteorism is the factor most to be dreaded in influencing the result of operation; the presence of gas and stomach contents is far less important, and large amounts of fibrin or the presence of an œdema of the peritoneum are less influential in the result than is meteorism. In this connection we would call attention to Cases 1, 13, 16, 18, and 19. All these patients were of an unhealthy appearance, breathing was superficial, and pulse was poor. On opening the abdomen a large amount of gas and stomach contents was found, but there was very little meteorism. Extreme flatulency of the intestine contra-indicated the more radical operation, so we used one of the aforementioned methods (not generally used by us). The severe cases (2, 3, 5, and 8) are not exceptions to our views, for in Cases 2, 3, and 5 we were forced to resect despite the bad condition of the patients, due to the poor state of the infiltrated peritoneum about the ulcer. The sutures all cut through so that it was impossible to complete the simple suturing. One covering of omentum and gall bladder offered such poor results that we hesitated to leave the patient with perforation so insecurely covered as perforation would undoubtedly result, and prove fatal. A gastric plication with a connecting gastro-enterostomy, which under favorable circumstances we have tried, would have taken less time than the resection which we carried out. Despite the presence of a high grade meteorism, as found in Cases 8 and 11, the time elapsed since operation argued against resection, still the patients bore the operation well.

Case 8 died of an unusual complication—thrombosis of the subclavian artery with subsequent gangrene of the upper extremity—after having fully recovered from the periton-

The intestinal function was fully restored on the second day after operation, the patient did not vomit, he could even take fluid diet, and he had no pain whatever in the abdomen.

Case 14 was operated upon immediately after perforation and is the only case in which the radical method can be said to have failed. At any rate before operation the patient showed symptoms of immediate collapse and had a rapid pulse; on the other hand the light grade meteorism and the good condition of the intestinal mucosa argued strongly for resection. A beginning pneumonia did not contra-indicate resection as in anæsthetizing the patient only 4 grams of Billroth mixture and 20 grams of ether were used.

A few words regarding technique of operation. The stomach is washed out, the patient anæsthetized with morphine and ether, and the abdomen opened through a median incision from sternum to navel. Even in the most difficult case it has not been necessary to enlarge the original incision. On cutting through the peritoneum, gas under pressure and ordinary fluid contents pour out through the duodenal perforation—infected peritoneal exudate mixed with stomach contents, food remnants, and bile. The stomach is pulled forward, while at the same time the liver is pulled back and upward. Generally at this point everything is visible. In most cases the perforation is located anteriorly in the duodenum or stomach near the pylorus. If the perforation is not found here, by blunt dissection one works backward through the gastrocolic ligament and thus easily reaches the opening through which stomach and intestinal contents are exuding. The perforation is closed temporarily with silk sutures, from pylorus to one-third the way to the cardiac orifice, and the gastrocolic ligament is separated by interrupted ligatures. In this way the view is unobstructed. There is a disadvantage in ligating the ligament in case a resection is to be done in that the stomach, as is known, has a rich blood supply. Our method of resection does not differ from that used by others. We emphasize particularly the necessity of isolating the abdominal field from the rest of the field of operation and especially of carefully sponging away pus and food contents followed by rinsing with hot physiological salt solution. With the exception of Case 5, drainage was not used and the wounds were closed primarily.

In the postoperative treatment we pay special attention to peritonitis. We stimulate the heart function with tonics and overcome the loss of blood by Murphy drips and subcutaneous infusions of physiological salt solution. In severe cases we depend upon intravenous infusion of hypertonic salt solution (15:1,000). In case of vomiting we empty the stomach by inserting carefully a stomach tube, which gives great relief and, so far as we have observed, does no harm. Twenty-four hours after operation the patient receives fluid in the form of tea and water, a teaspoon every half hour. This is increased from day to day. We generally begin giving fluid nourishment *per os* on the fifth or sixth day. On the ninth or tenth day the patient is given semisolids, and 2 weeks after operation the patient is permitted to eat everything, but not too much at a time.

To study our results, we examine our patients, after a lapse of time, with the X-ray (Drs. Eisler and Werner). We have found that no change has taken place in the wall which would indicate ulcer in any of our cases. In Case 4, 1½ years after operation, the patient complained of slight pain at the point of resection; he had never vomited and the pain had no relation to meals. Roentgen examination showed no changes in the wall and the stomach emptied through the anastomosis normally and in the usual time. One patient could not be reached by mail as he had moved, leaving no address. Two other persons could not appear personally, so sent us cards telling us of their condition, which tallied with the above satisfactory findings.

The patients are all free from distress, have good appetites, and eat anything. In all there has been an increase in weight and all have been able to resume their original occupations. They have been cured of the severe suppurating peritonitis, they have had no attacks of severe distress, are free from the fear of a second dangerous operation, and are restored to perfect health.

On the strength of our experience, we would recommend that, wherever possible, stomach resection be done in cases of ulcer of the stomach and duodenum, even in the presence of perforation and peritonitis, also that the older methods be used only [illegible] is possible. We have shown that the radical method is practical both as far as operating is concerned and as to result, since with proper indications there is only a small mortality.

Case 1. Servant, age 20, admitted to hospital, July 11, 1913, with [illegible] from stomach trouble [illegible] ing the patient complained [illegible] in the epigastrium. On admission temperature was 36.7° C., pulse 96. The facies were hippocratic. Patient was a vigorous man of middle size. Breathing was costal, superficial. He had [illegible] not vomit, and the abdomen was not tense. Meteorism was present in slight degree. Operation was done 5 hours after perforation. The perforation was 1 centimeter in front of the pylorus, on the anterior gastric [illegible] curvature. There was a small amount of turbid exudate and of stomach contents and gas in the abdominal cavity. Light meteorism was present in the intestines. There were deposits of fibrin in the serosa which was red and somewhat œdematous. A resection following the Kroenlein method, with primary closure without drainage, was done. Narcotic used: 15 grams [illegible] Patient had smooth convalescence and was dismissed from the hospital August 15, 1919. We have been unable to locate him with follow-up letter.

Case 2. Clerk, age 45, admitted September 5, 1919. For 3 weeks patient had complained of distress in the stomach. Last night the pain located in the epigastrium became very severe and he vomited. On admission pulse was 78, temperature [illegible] The entire abdomen was tense, hard as a board, and very painful to pressure, chiefly in the epigastric region. Operation was done 27 hours after perforation. Some gas and exudate were found in the abdominal cavity. The perforation was located on the anterior duodenal wall 2 centimeters from the pylorus. Meteorism was quite marked. The wall was thickened, intensely red, and œdematous, and contained many [illegible] A resection of the stomach, following the Kroenlein technique, was done, and the wound closed without drainage. Narcotic used: 20 grams mixture, 200 grams ether. Convalescence was [illegible] and patient was dismissed as cured on September 20, 1919. The patient writes that he has no trouble at all with his stomach and can eat anything. He has gained 7 kilograms in weight since operation and is perfectly able to continue his usual occupation.

Case 3. Director, age 52, admitted October 15, 1919. For 16 years he has suffered with [illegible] ago he had bloody stools. While walking near the [illegible] men is hard [illegible] and [illegible] chiefly in the [illegible] tion. Some gas and stomach contents were present in the abdominal cavity. The perforation was located in the mid portion of the pyloric wall, and pro- [illegible] stomach was done, following the Kroenlein technique. [illegible] Convalescence was smooth and patient was discharged. [illegible] patient states that he feels perfectly well, can eat anything, and in considerably greater quantity than formerly. He has gained 6 kilograms in weight and has a [illegible] stump on the left side and emptying time is prompt. [illegible] painful on pressure.

[illegible] pain. On admission pulse was 120, arhythmic, temperature 36.4°C. Patient was prostrated and badly emaciated. Breathing was superficial, and the [illegible] extremely painful to pressure. She [illegible] contents were found in the abdominal cavity. There was a perforation near the lesser curvature in the [illegible] intensely red, greatly thickened, œdematous, and con- [illegible] mixture, 200 grams ether. Convalescence was smooth [illegible] 1920. Up to July, 1921, patient remained entirely [illegible] Since that time she has had two [illegible] of pain without eructation and vomiting, not [illegible] ted with eating. She can eat anything [illegible] shows stump of moderate size, which empties very quickly. The jejunum is somewhat dilated. No [illegible]

Case 5. Woman, peddler, age 56, entered hospital [illegible] from gall stones. On the day [illegible] admission to hospital she had violent pain in the [illegible]

ination shows pulse 120, arhythmic; temperature [illegible] woman of moderate strength with hippocratic facies. The abdomen is very tense and painful on pressure, chiefly in the iliocæcal [illegible] vomited profusely and had violent hiccough. Operation was done 36 hours after perforation. Enormous quantities of gas and pus with [illegible] contents were found in the abdominal cavity. The serosa was thickened, intensely red, and contained deposits of fibrin. The perforation [illegible] located on the anterior wall of the stomach close to the pylorus. A resection of the stomach, after the method of Kroenlein, was done and two drains were placed in the iliocæcal incision. Narcotic used: 10 grams mixture, 200 grams ether. Patient died December 3, 1919. Postmortem examination showed a subacute tuberculosis of both superior lobes, brown atrophy of the heart, and a diffuse purulent peritonitis.

Case 6. Printer, age 51 years, was admitted November 20, 1919. For 30 years he had suffered periodic distress in the stomach. On day of admission patient suffered a sudden, acute attack of extreme pain in the epigastric region, associated with violent vomiting. Pulse was 96, temperature 36.7° C. Patient was of moderate strength, and appeared ill. The abdomen was drawn in and tense, hard as a board. There was a tympanitic sound underneath the sternum. Time elapsed between perforation and operation not known. Operation revealed much gas and some exudate in the abdominal cavity. The perforation was located on the anterior pyloric wall. There was a light meteorism. The serosa was red, somewhat thickened, and contained deposits of fibrin. A stomach resection after the method of Kroenlein was done and the wound closed without drainage. Narcotic used: 10 grams mixture, 80 grams ether. Convalescence was smooth and patient was dismissed as cured on February 9, 1920. Patient gained 7 kilograms in weight, can eat anything, and has a good appetite. He has returned to his work as printer. On July 15, 1921, roentgenogram showed a well contracted stump of moderate size, emptying time short, and no change in walls. At this time there is no point which is painful on pressure.

Case 7. Grinder, age 29, was admitted February 26, 1920. For 9 years patient has suffered from stomach trouble, with intervals of 5 to 6 weeks in which he would be free of distress. Perforation occurred with intense pain after patient had eaten of a rich meal. There was no vomiting and no hiccough. On admission the pulse was 60, temperature 37.2° C. Patient is a vigorous man with sunken cheeks. He has a diffuse bronchitis. The abdominal walls are hard as a board. The epigastric region is extremely sensitive. Operation was done 5 hours after perforation. Much gas and some free exudate were found in the abdominal cavity, chiefly beneath the liver. Perforation was located on the duodenum, close to the pylorus. No meteorism was present. The serosa was red, somewhat œdematous. A stomach resection after the method of Kroenlein was done and the abdominal walls sutured. Narcotics used, 5 grams mixture, 110 grams ether. Convalescence was smooth, and the patient was dismissed as cured on March 28, 1921. The patient gained 4 kilograms in weight, eats well and anything—has no trouble at all.

Case 8. Ironworker, age 29, admitted March 15, 1920. For 3 years patient had suffered with stomach trouble. Perforation was associated with intense pain so that patient almost fainted. On admission pulse was 72, temperature 36.7° C. Patient was a vigorous man with sunken cheeks. Breathing was short and superficial. The abdomen was tense and hard as a board. Sensitiveness was evident, chiefly in the epigastric region. He had violent hiccough. Operation was done 4¾ hours after perforation. On opening the abdomen a large amount of gas and gastric juice was found. Perforation was located on the anterior wall of the duodenum close to the pylorus. There was no meteorism. The serosa was only slightly thickened and red. Stomach resection after the method of Kroenlein was done and the abdominal wound closed. Narcotic used: 18 grams mixture, 110 grams ether. Convalescence was smooth and the patient was dismissed as cured on March 28, 1920. On July 13, 1921, the patient reports that he is free from distress, can eat anything and in larger quantities than before operation. Roentgenological examination shows a well contracted stump of moderate size, with prompt emptying of the stomach contents. There is no change evident in the walls and no point of sensitiveness on pressure.

Case 9. Tailor, age 24, entered hospital June 13, 1920. Until 2 days ago he had never had trouble with his stomach, but at this time he has severe pain and on the afternoon of the day before entering hospital he was seized suddenly with terrific pain in the epigastrium. He did not hicccough and did not vomit. On admission the pulse was 90, temperature 36.3° C. He was a moderately strong man, slightly cyanotic. The region of the epigastrium was tense and extremely sensitive to pressure. Sixteen and one-half hours elapsed between perforation and operation. On opening the abdominal cavity there were found much gas, exudate, and gastric contents. Perforation was located on the anterior wall of the duodenum, close to the pylorus. There was present a light meteorism, and the serosa was intensely red, much thickened, and contained deposits of fibrin. Stomach resection after the Kroenlein method was done and the abdominal wound closed without drainage. Narcotic used: 5 grams mixture, 180 grams ether. Convalescence was interrupted by a bilateral pleurisy. Patient was dismissed cured on July 13, 1920. Aside from a short period, November 19, to December 17, 1920, when an operation for abdominal pressure was done, patient has had no trouble at all. He can eat anything and has gained 4 kilograms in weight. X-ray examination shows a well contracted resection stump of moderate

size. Emptying time is moderately prompt. There is no change in the walls, and no point painful to pressure.

CASE 10. Director, entered hospital, March 3, 1920. For a year patient has been suffering from stomach trouble. Perforation was brought on by lifting a heavy load. On admission pulse was 85, temperature 37.5° C. Patient is weak with hippocratic facies. The abdomen is hard as a board, and is especially sensitive to pressure in the epigastric region. Operation was done 7 hours after perforation. On opening the abdominal cavity much gas and exudate were found. The perforation was situated on the anterior wall of the duodenum, close to the pylorus. There was present a light meteorism, the serosa was red, thick, and there were fibrin deposits on the serosa. Stomach resection was done following the method of Kroenlein and the abdominal wound closed. Narcotic used: 20 grams mixture, 220 grams ether. Convalescence was smooth and the patient was dismissed as cured on April 30, 1920. On July 15, 1921, patient reports that he is feeling perfectly well, can eat anything, and is able to continue with his usual occupation. He has gained 4 kilograms in weight. X-ray examination shows a well contracted resection stump of moderate size, and emptying time is moderately prompt. There is no change in the walls and no point painful on pressure.

CASE 11. Workman, age 50, entered hospital September 10, 1920. For 1 year he has been suffering with stomach trouble. After a heavy meal of cabbage, he was suddenly seized with intense pain in the epigastrium, and violent hiccough. Examination shows pulse 136, temperature 37.3° C. Patient is weak and ill looking. The abdomen is drawn in and is extremely sensitive to pressure. Operation was done 18 hours after perforation. On opening the abdomen large quantities of gas and stomach contents were found. The perforation was located on the anterior pyloric wall. There was marked meteorism. The serosa was thickened, red, and on it were deposits of fibrin. It was easily perforated. A stomach resection after the method of Kroenlein was done and the abdominal wound closed. Narcotics used: 100 grams ether. The patient died September 11, 1920. Postmortem examination showed diffuse peritonitis and weakness of the heart.

CASE 12. Merchant, age 41, entered hospital September 15, 1920. Patient had formerly been well until 20 hours ago when he was seized with intense pain in the region of the stomach. Soon afterward he had violent colic-like pain throughout the abdomen, and hiccoughed violently. On admission pulse was 130, temperature 38.7° C. Patient was a vigorous man who showed the evidences of being very ill. He vomited profusely. The abdomen was distended and very painful to pressure. Patient was operated upon 20 hours after perforation. On opening the abdomen much gas and rich exudate were found. The perforation was found on the anterior duodenal wall, close to the pylorus. Strong meteor[illegible] of fibrin, and was easily perforated. [illegible] died September 17, 1920. Postmortem examination showed [illegible] the right ureter, directly in front of the urinary bladder, also diffuse [illegible]

CASE 13. [illegible] October [illegible] stomach, chiefly at night. Perforation occurred during [illegible] pulse [illegible] vigorous man showing evidence of extreme [illegible] The abdomen [illegible] violently. Operation was done 11 hours after [illegible] foration. On opening the abdominal cavity some [illegible] was found on the anterior duodenal wall [illegible] to the pylorus. There was light meteorism. The serosa was thickened and reddened. Stomach resection after the Kroenlein method was done [illegible] the abdominal wound closed. Narcotic used: [illegible] grams mixture, 100 grams ether. Convalescence was smooth and patient was discharged as cured on November 28, 1920, after being treated with arsenic. Report on July 28, 1921, states that the patient is feeling perfectly well, can digest all food, and has increased 5 kilograms in weight. X-ray examination shows resection stump on left side and rather prompt emptying time. There is no change in the walls. Somewhat to the right of the stomach is a point painful to pressure.

CASE 14. Workman, age 42, entered hospital October [illegible] with severe distress of the stomach. Roentgen examination [illegible] Perforation followed a period free from pain and was [illegible] ated with intense pain and vomiting. On admission pulse was 130, temperature 36.4° C. Patient is a vigorous man, with peritonitic facies. The abdomen [illegible] tender and [illegible] Operation was done 4 hours after perforation. On opening the abdominal cavity much gas and stale stomach contents were found. The perforation was found on the lesser curvature near the pylorus. There was some meteorism. The serosa was red, somewhat thickened. Stomach resection after the method of Kroenlein was done and the abdominal wound closed. Narcotic used: 4 grams mixture, 140 grams ether. Patient died October 29, 1920. Postmortem showed lobular pneumonia and diffuse peritonitis.

CASE 15. Workman, age [illegible] entered hospital December 22, 1920. For 18 years patient has suffered with stomach trouble. Pain comes on 1 hour after eating and also at night, and he suffers with eructations. Perforation was associated with intense pain but patient did not vomit. On admission pulse was 104, temperature 36.3° C. Patient is weak and [illegible]

pressure, especially [illegible]. Operation was done 5 hours after perforation. On opening the abdominal cavity a large amount of gas and stomach contents was found. The perforation was found on the lesser curvature near the pylorus. There is some meteorism. The peritoneum is red and œdematous. A stomach resection after the method of Kroenlein was done and the abdominal wound closed. Narcotic used: 2 grams mixture, 280 grams ether. Convalescence was smooth and the patient was dismissed as cured on January 5, 1921. On June 17, 1921, patient reports no trouble at all, he can eat anything, and has gained 8 kilograms in weight. X-ray examination shows a resection on the left side and prompt emptying time. There is no change in the walls and no point painful to pressure.

Case 16. Servant, age 46, entered hospital December 29, 1920. For 14 years patient has suffered with stomach distress—severe colic and cramps in the epigastric region, pain extending from the sacrum to the shoulders, sour eructation. For 10 days the pain has increased in intensity and on the evening before entering hospital patient experienced feeling as though something gave way in abdomen. On admission pulse was 160, temperature 36.6° C. The patient looks miserable, the abdomen is drawn in and is hard as a board. He vomits violently. Operation was done 6 hours after perforation. On opening the abdomen much gas and exudate was found. The perforation was located on the lesser curvature close to the pylorus. There is light meteorism. The peritoneum is red and œdematous. A stomach resection following the method of Kroenlein was done and the abdominal wound closed. Narcotic used: 4 grams mixture, 110 grams ether. Convalescence was smooth and patient was dismissed as cured on February 2, 1921. Letter from patient in middle of June, 1921, states that he is entirely free of distress.

Case 17. Coachman, age 44, entered hospital April 19, 1921. For 4 weeks he has had stomach trouble, and on evening before entering hospital, while lifting a heavy load, patient was seized with violent pain, and perforation occurred. Examination on admission showed pulse 120, temperature 37° C. Patient is a vigorous man but is extremely dyspnœic. The legs are drawn to the body, the abdomen is hard as a board and is sensitive to pressure chiefly in the gastric region. Patient hiccoughs. Operation was done 13 hours after perforation. On opening the abdominal cavity a large quantity of gas and exudate was found. The perforation was found on the anterior duodenal wall, near the pylorus. There was light meteorism. The peritoneum was red, thickened, œdematous, and showed deposits of fibrin. A stomach resection after the Kroenlein method was done and the wound closed. Narcotic used: 28 grams mixture and 100 grams ether. Patient died April 23, 1921. Postmortem examination showed thrombosis of left subclavian artery with gangrene of the left upper extremity.

Case 18. Workman, age 54, admitted April 14, 1920. For 1 year patient has suffered with stomach trouble. Perforation was associated with intense pain and no vomiting. On admission pulse was 120 and weak, temperature 36.5° C. Patient was a vigorous man but showed evidence of illness. The abdomen was tense, somewhat inflated, painful on pressure, chiefly in the umbilical region. Operation was done 5 hours after perforation. On opening the abdominal cavity a large amount of gas and exudate was found. The perforation was on the posterior duodenal wall, near the pylorus. There was light meteorism. The peritoneum was red, somewhat œdematous. A stomach resection after the method of Kroenlein was done and the abdominal wound closed. Narcotic used: 40 grams mixture, 240 grams ether. Convalescence was smooth and patient was dismissed as cured on May 2, 1921. On July 12, 1921, patient is entirely free of distress, can eat anything and in larger quantities, and is able to continue with his usual occupation. X-ray examination shows a short, somewhat dilated stump, with prompt emptying time. There is no change in the walls. There is a point painful to pressure just outside and to the right of the stump.

Case 19. Machinist, age 46, entered hospital May 31, 1920. Patient had suffered periodic distress in stomach for past 20 years. He had severe attacks of vomiting of sour masses. Perforation occurred when patient was bending during an attack of pain and vomiting. On admission pulse was 96, temperature 37.6° C. Patient is of moderate strength, breathing is superficial, and the cheeks sunken. The abdomen is somewhat distended and is painful to pressure throughout. Operation was done 8 hours after perforation. On opening the abdominal cavity a large quantity of gas and stomach contents was found. The perforation was located on the anterior duodenal wall, close to the pylorus. The peritoneum was red and a little thickened. A stomach resection after the Billroth I method was done and the wound closed. Narcotic used: 15 grams mixture, 80 grams ether. Convalescence was smooth and patient was dismissed as cured on June 11, 1921. Report on July 12, 1921 shows patient entirely free of complaint. He eats four good meals a day and has gained 5 kilograms in weight. X-ray examination shows a moderate sized stump with moderate emptying time. There is no change in the walls and no point painful on pressure.

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MARGINAL ULCER AFTER A MODIFIED PÓLYA OPERATION

[illegible]

THE question of marginal or gastro-jejunal ulcer following a gastro-enterostomy has, of late, interested many surgeons and a large number of such cases has been reported in recent years. It would seem from reading these reports that a gastro-enterostomy for a gastric or duodenal ulcer is a poor operation, and yet, for the majority of cases that one sees, it is apparently the best operative proceeding that we have to offer at present. The one operation that can possibly replace a gastro-enterostomy is the pyloroplasty of Horsley, and the field for the latter is limited to a comparatively small number of duodenal or postpyloric ulcers without extensive cicatrization and very limited in size. A marginal ulcer is known to have followed other anastomosing operations as Erdmann has described one after a Billroth No. 2, and we are now describing one after a modified Pólya operation.

As far as we know, at present, the cause of gastric and duodenal ulcer is probably a hæmatogenous infection from some other primary focus, as demonstrated by Rosenow, by some specific bacterium, and it would seem quite possible that the cause of a marginal ulcer in a patient after a gastro-enterostomy is a reinfection by the same bacteria on account of non-removal of the original primary focus. It is very possible that there are other factors which aid in the formation of marginal ulcers and yet these may be purely secondary. Among them we may mention the following:

Non-absorbable suture material. It is true that silk and linen thread have been found in many marginal ulcers and yet many cases have been reported where only absorbable suture material had been used throughout the operation.

The use of heavy clamps. Trauma and lacerations from the use of Roosevelt, Allis, and other tightly applied clamps may and may not help in the formation of these ulcers. They are not reported after the large resections for carcinoma of the stomach in which traumatism to the stomach wall is of necessity much greater and in which heavier clamps are often applied with greater force. It is possible, however, that marginal ulcers may occur after these resections and may be obscured by local recurrences. The fact remains, however, that marginal ulcers are reported after operations by surgeons who use no clamps whatsoever.

Syphilis. Erdmann mentions this disease as having been shown in three out of five ulcers excised and examined microscopically, and yet this condition can not be given as a definite causative factor in the majority of cases.

Chemical changes. Hyperacidity has often been blamed for the formation of gastric and duodenal ulcers and at present, according to Horsley, it is the most important etiological factor in the formation of marginal ulcers. [illegible] needs [illegible] on this point. It has never been definitely decided whether hyperchlorhydria is a causative factor of ulcer or whether it is only found when the ulcer has actually made its appearance. Cases are frequently seen in which there is no excessive secretion of hydrochloric acid.

It is true that the marginal ulcer is usually seen in the wall of the stoma itself or in the wall of the jejunum opposite the stoma, a fact which would seem to show that the ulcer is due to the chemical irritation of the acid gastric juice not neutralized by the alkaline duodenal contents. Yet we know that many ulcer cases are seen where there is no hyperacidity, and Lewisohn has lately reported a case of marginal ulcer where a hypoacidity was present in the gastric contents.

Several authors have used the words "personal idiosyncrasy in the production or reproduction of marginal ulcers" or "surgical"; this simply means that an operation was done for the cure of an ulcer and that, in spite of dietary and medical care, another ulcer ap-

Fig. 1. Before operation. Marked pyloric stenosis, pyloric end of stomach greatly dilated; cap distorted beyond recognition; pyloric sphincter deformed.

peared at a new site, although the original one had been, apparently, cured in the meantime. In two of Erdmann's cases there were, apparently, two new ulcers appearing since the operation for the original one. In all probability, "idiosyncracy" simply means reinfection at a new site from an undiscovered primary focus. Where such a primary focus is discovered and removed, medical and dietary treatment probably will cure many ulcers. A gastro-enterostomy, without the removal of the primary focus, will probably permanently cure many ulcers where the agent of infection from the primary focus is one of slight virulence. Where, however, the virulence of the bacteria is great, a gastro-enterostomy may cure the original ulcer but a new ulcer may be caused by the same bacteria from the unremoved, primary focus, in the new stoma which is an area, irritated by non-absorbable sutures, traumatized by heavy clamps, or burnt by highly acid gastric contents, and, therefore, an area the resistance of which to bacterial infection has been materially decreased.

The following case is reported because, in a search through the literature, no other case of a marginal ulcer following a Pólya operation was found and because the clinical course of the formation of the second ulcer could be followed so closely.

The patient was a very energetic white man of 45, the editor of a scientific journal whose work required long hours and who, for many years, had had his meals at irregular intervals. He entered the French Hospital on July 7, 1916, with the following history: He had had the usual diseases of childhood and typhoid at the age of 22. Otherwise he had been well until 5 years before when he began to have attacks of indigestion which usually came on after a period of hard work. These attacks were characterized by some nausea, acid eructations, a feeling of fullness in the epigastrium, but no real pain. The attacks lasted for only a few hours at a time. In the early spring of 1916 he could not eat a real meal without vomiting and so lived by taking small quantities of food at frequent intervals. There had never been any blood in the vomitus or in the stools. His bowels had been regular up to within a few months before his admission to the hospital when he became very constipated. He had lost 20 to 25 pounds in weight in the last 2 years. Physical examination at the time of his admission showed nothing abnormal except for a moderate amount of gastric dilatation. He had a red cell count of 4,700,000, a white count of 15,400 and a hæmoglobin of 90 per cent. Gastric analysis showed a total acidity of 105, and a free hydrochloric acid content of 65, and no blood. The fæces were negative for blood. The examination of the urine was negative as was the Wassermann. The roentgenographic findings by Dr. Cole, on June 15, 1916 were as follows:

The stomach was dilated and prolapsed. The peristalsis was very active, of the four-cycle type; equal on the greater and lesser curvatures and unobstructed. The jejunum showed distinctly. The duodenum passed down behind the pyloric end of the stomach. The cap was distorted almost beyond recognition and the sphincter was almost obliterated. The pyloric end of the stomach expanded and contracted normally except for the extreme gastric dilatation. At 2 hours the stomach showed that relatively little food had passed out of the stomach and at 6 hours there was still a great deal of retention in the stomach.

From these plates Dr. Cole made a positive diagnosis of a postpyloric ulce with marked obstruction.

He was operated on July 9, 1916, by Dr. Hoguet, the following operation being done. The abdomen was opened by a right rectus incision 4 inches in length. The stomach was found greatly dilated and a broad band of scar tissue was present just to the left of the pyloric ring. There was a broad, indurated ulcer, mostly on the anterior surface, immediately to the right of the pyloric ring and extending outward on the duodenum. The stomach was completely divided from the lesser to the greater curvature about 2 inches to the left of the pylorus. A number of adhesions were found when the posterior stomach wall was divided, and these were tied and cut. The duodenal stump was then closed with a through-and-through suture of No. 1 chromic gut and the suture line inverted by a continuous Lembert

Fig. 2. After operation. No pyloric stenosis; stomach normal in size and shape; no cap shown; normal gastric peristalsis.

Fig. 3. First recurrence after operation; stenosis at stoma; stomach dilated; no cap; arrow indicates crater ulcer or ulcerating carcinoma.

suture of Pagenstecher. An end-to-side anastomosis was made between the cut end of the stomach and the jejunum, a Pagenstecher suture being used for the serosal stitch and No. 1 chromic gut for the mucosa. The jejunum lateral to the anastomosis was then sutured to the sides of the hole in the gastrocolic omentum. The abdominal wall was closed by layers in the usual way.

The patient made an unusually good recovery from this operation and was discharged from the hospital on July 26, 1916, under medical and dietary supervision.

A roentgenographic examination made in December, 1916, showed: the size and shape of the stomach and also its position to be almost perfect. From the plates one could not tell that there had been any operation on the stomach itself. The 2 hour plates showed the stomach almost completely empty, there being only a slight trace of barium in the stomach at that time. The 6 hour plate showed the stomach completely empty, the head of the column in the ascending colon and the tail in the coils of the ileum.

The patient resumed his work in the fall of 1916 and complained of nothing until February, 1917, when he began to notice some acid eructations, which were followed in a few days by nausea and vomiting. The vomiting had no relation to his meals but usually occurred at night and consisted generally of liquids without any undigested food material and never contained blood. He had no abdominal pain.

A roentgenographic series made March 15, 1917, showed the stomach greatly dilated and somewhat prolapsed. The peristalsis was hyperactive and yet little food had entered the jejunum. At 2 hours there was shown marked retention and at 6 hours there was the same retention as at 2 hours. Just beyond the stoma in the jejunum there was evidence of a definite crater about one-half inch in length and one fourth inch in width. Surrounding this crater area which seemed to be a large infiltrated mass constricting the lumen of the gut at that point. From these plates Dr. Cole made a positive diagnosis of a jejunal ulcer with a considerable amount of induration, causing obstruction of the passage of food.

He entered the hospital in the latter part of February, 1917, and was put on a Lenhartz diet and kept in bed. His symptoms rapidly disappeared, and he was discharged on March 25, 1917. He remained at home for several weeks under treatment. He was perfectly well except for a slight attack of indigestion in December, 1918, which only lasted a few weeks and which disappeared rapidly under dietary treatment. Until the fall of 1920 the patient was free from symptoms but in November began to complain of a feeling of general malaise and an uneasy feeling in the stomach. On December 13, 1920, he had, for the first time, a definite attack of pain in the epigastrium which came on a few hours after a meal and was somewhat relieved by bicarbonate of soda. The pain kept up for several days and was accompanied by some nausea. There was no blood in the stools. He came to Boston to the hospital December 20, 1920. Physical examination at that time showed slight enlargement of the stomach and a very slight tenderness in the mid-line just above the umbilicus. A roentgenographic examination at this time did not show the duodenum and the cap. The stoma showed distinctly and there was a persistent fleck of barium just above it. There was a marked gastric retention at 6 hours which persisted up to 24 hours. There was also a retention of some barium in the ascending colon in the 24 hour pictures.

From this examination Dr. Cole made a positive diagnosis of a rather large ulcer on the upper aspect of the jejunum just beyond the gastric stoma with

Fig. 4. Second recurrence after operation. Stenosis of stoma; stomach dilated; no cap; arrow indicates crater of ulcer of jejunum, hyperperistalsis.

Fig. 5. Second recurrence just before final operation. Stenosis of stomach; arrow indicates small crater surrounded by much induration. Hyperperistalsis.

enough induration to cause obstruction and 24-hour retention.

He remained in the hospital until January 10, 1921, under strict dietary treatment and then returned to his home, where the medical treatment was continued under the supervision of Dr. M. A. Ramirez. A roentgenographic examination was made in March, 1921.

A series of plates made of the stomach immediately after a bismuth meal was administered, showed very considerable dilatation of the stomach and excessive peristalsis. In spite of the peristalsis there was definite evidence of stenosis at the point of the gastric stoma which was contracted to about the size of a goose quill. There was definite evidence of a crater just beyond the stomach and evidence of dilatation of the jejunum just proximal and just distal to the stoma. There was an immense amount of induration surrounding the stoma, particularly above it. This finding, compared with the previous examination, showed practically the same condition with the induration and cicatrical contraction greater at this time.

There was very definite evidence of gastric retention up to 24 hours.

From a study of these plates Dr. Cole made a diagnosis of a jejunal ulcer just beyond the stoma, with marked contraction of the stomach, and surrounded by a large amount of induration.

After a consultation it was decided to operate for the marginal ulcer. The patient re-entered the hospital on April 3, 1921, and the following operation was done: On opening the abdomen through a right rectus incision the omentum was found adherent to the under surface of the abdominal wall. The gall bladder was found to be normal, but the appendix showed definite signs of a chronic inflammatory process and was bound down at its center. It was removed in the usual way. The cæcum was then explored, and several strong bands of adhesions running across it were found and divided. These bands were evidently the cause of the stasis in the ascending colon that had been noted in one of the roentgenograms. The anastomosis between stomach and jejunum was found covered by many adhesions. The opening in the gastrocolic omentum was found from below and was dissected away from the stoma. The ulcer was at the margin of the anastomosis and was larger on the gastric than on the jejunal side, but formed a definite ring of fibrous tissue completely surrounding the stoma. Directly opposite the stoma was a pouch in the jejunal wall about three-quarters of an inch deep. The anastomosis was cut directly across with a knife and the opening in the stomach closed with two layers of chromic catgut. The opening in the jejunum was closed at right angles to its long axis with two sutures of chromic. The caliber of the jejunum was then tested and found to be large enough. A posterior gastro-enterostomy was then done about 1.5 inches away from the

sutured end of the stomach, the jejunum being used at about 4 inches distal to the old anastomosis. The abdomen was closed in the usual way.

Several points in the operative findings are worthy of consideration. First, that the ulcer had apparently started in the wall of the jejunum, had enlarged so that it had encircled the stoma and then had cicatrized so that, at operation, the latter was scarcely as large as a lead pencil in its diameter.

The second point is that no remains of non-absorbable suture material were found in dividing the old anastomosis.

The third is that several bands of stout adhesions were found constricting and angulating the ascending colon and an appendix that was distinctly pathological. In this case, might not the inflamed appendix or the constricted colon have been the cause of both the first and second ulcers?

The patient did very well until the sixth day after operation when the nurse reported a discharge on the dressings. When the latter were removed it was found that the [illegible] inches at its lower angle, through the peritoneum. This was immediately resutured [illegible] more when his temperature and pulse rate started to rise, and he died on the [illegible] first operation.

A [illegible] general peritoneal infection. The stomach was not distended and the new anastomosis seemed to be firmly healed. There was no kinking near the [illegible] There was a mass of [illegible] sutured pyloric end of the stomach and on separating these it was found that the sutured ends of the gastric walls at the [illegible] had not united and that a [illegible] between stomach walls and [illegible] there was about an ounce of pus. The sutured incision in the wall of the [illegible] anastomosis had been divided, was tight.

MEGASIGMOID, MEGARECTUM, FÆCAL BOLUS

By FREDERICK G. CORBIN, M.D., C.M., Mendoza, Argentine R[illegible]

I WISH to use the word megasigmoid as that, to my mind, best implies the pathological condition I am about to describe. For the last 22 years in this city of Mendoza, we have been fighting megarectosigmoid and fæcal bolus, and have been studying its cause and effect. During this time I have observed from an experience with some 200 cases, the following: First, that the world's literature on this subject is almost *nil*, especially in view of the gravity and frequency of this disease here. Second, that many deaths in Mendoza are caused by megasigmoid or are rather direct consequences of this condition. Third, that appendicitis, gastric ulcer, duodenal ulcer, and cancer of the rectum, about which so much appears in the world's literature, all together do not cause so many deaths in Mendoza as do megasigmoid and its direct sequelæ. Fourth, that megasigmoid is much more common in Mendoza than in Europe, North America, or Buenos Aires. Fifth, that there is a great deal of confusion among authors, many describing congenital megacolon and megasigmoid and megarectosigmoid as if they were all one disease.

I do not remember ever seeing or hearing of a case of fæcal tumor in the Montreal General Hospital during my student years at McGill, from 1885 to 1890. The same may be said of my 6 months in 1890 spent in the British Hospital in Buenos Aires. I saw a few cases of coprostasis which, with a simple soap suds enema followed or preceded by a dose of castor oil, were easily relieved.

Of my early years of practice I have no written records, but in the Rio Negro from 1890 to 1894, I remember only one case of fæcal tumor and one of volvulus of the sigmoid; the latter in a police autopsy; poisoning was given as the cause of death.

In Chascomus, where from 1894 to 1898, I did the surgery of both hospitals (80 beds), I remember only one [illegible] fæcal tumor. In 1900 I saw and helped the late Dr. Vicente

Megarectosigmoid. Roentgenogram taken after 4,000 gram enema containing 500 grams barium. The megarectosigmoid extends up into the thorax, then the normal ?) sigmoid comes back to the pelvis and becomes the descending colon in normal situation. The cæcum and ascending colon are not seen as it is covered by the megasigmoid.

This case is noteworthy only because it is in a girl of 18 years. Case of Dr. Metraux, January, 1922.

Llobet do his operation: i.e., laparotomy and crushing of the fæcal mass *in situ*. Later on I will again speak of this.

In the Buenos Aires hospitals they tell me that *now* this disease is comparatively rare. There are cases and with the aid of the X-ray they find many megacolons and megasigmoids without fæcal tumor, and strange to say, without the patients suffering any disagreeable consequences. However, 20 years ago I believe it was much more common to see the fæcal tumor as a consequence or possibly as a cause of megasigmoid, more especially here in Mendoza where, as I said before, it was and is much more common than in other sections.

Megacolon is considered by European authors as a congenital disease, and megasigmoid, I believe with my colleagues here, is a consequence of fæcal tumor which is at first caused by simple sigmoid stasis

We may be mistaken. These enormously dilated sigmoids, with their walls three or four times the normal thickness, may have originally been congenital megacolons which, by the accumulation of excrement, at times in enormous quantities, and the extraordinary muscular forces called into play to expulse it, has produced an entirely new condition in its muscular coat. The condition may be compared with the change produced in the normal individual who takes up physical exercise, gymnasium work, places himself on a diet, in other words "trains" and as a result becomes a giant in strength and endurance; or to the development of the gastrocnemius of the cyclist. In the same way it is possible that the presence of fæcal matter in the lower part of the colon and upper part of the rectum, produces in their muscular coat an excessive development with fibrous changes later on. Is it necessary that there be a congenital dilatation or an abnormal fold in the sigmoid for this to happen? No! At least I believe that all this may and does happen in a normal sigmoid and that it is a frequent occurrence.

In nearly all the cases which I have seen and examined (some 200) I have found on digital examination a narrowing in the rectum which corresponds to the peritoneal fold which exists normally around the first part of the rectum, but only in *front* of the second part; that is to say, in the line of division, according to our anatomical nomenclature, between the first and second part of the rectum (Perthes' fold). Above this fold the fæcal matter becomes lodged and accumulates; below this point it does not pass. Only twice have I seen fæcaloma in the ascending colon and only once in the transverse.

Normally, according to the best authors, the narrowest part of the large intestine is the first part of the rectum. This narrow part, conical in shape, is smallest exactly at the point mentioned above (Perthes' fold). Passing this we come to the wider part which

forms the rectal pouch. This first part of the rectum, at the same time the narrowest, forms an "S" from left to right and from before backward.

In 95 per cent of my cases of fæcal accumulation, this first part of the rectum and the iliac sigmoid immediately above are the situations chosen. *Here* is the dilatation; *here* is the tumor; and *here* is the degeneration of the muscular coat of the intestine. It is here that the fibrous tissue replaces the muscular to a great extent; and the normally elastic intestine loses all its contractile power. Soap suds and oils clean out the rectal pouch in the second part of the rectum; but the fæcaloma, big and hard in the rectosigmoid segment, resists all medical treatment, sometimes for weeks. This mass by its own weight, given a long and weak mesosigmoid, seeks for the place of least resistance, migrating to the middle line and often to the right side of the abdomen.

This emigration of the sigmoid and the first part of the rectum from its normal situation is undoubtedly favored by the mesos mentioned, always long and weak in persons who suffer from this disease. This lengthening may be the *congenital* part in these cases, as Barth claims. There is in front a muscular wall, to the left and behind a bony wall, making the middle line and the right side the natural localities for the final enlargement of the tumor which, once started, very quickly increases in size.

The first consequence of this emigration is the formation of a kink in the first part of the rectum at or near its union with the second part; making it more difficult, if not impossible, for the passage of the accumulated fæcal matter. This kink may be helped in its formation by a congenital abnormal state of the mesosigmoid and mesorectum.

Gas is the best dilator and it is rare that, even when the tumor has reached enormous size, there is complete obstruction. The gases prevent this, passing between the fæcaloma and the intestinal wall which they gradually stretch, dilating the lumen of the bowel to many times its natural size.

Both Dr. Metreaux, of this city, and I have noted "chimneys" in these tumors which admit the passage of gases and liquid fæces. The intestinal walls, often stimulated by drugs, do their best to shove on this mass; and without doubt the normal peristaltic movements are increased in these cases at least at first. The results are multiple: a hard tumor forms, the walls lose their form, size, and thickness, their muscular coat is converted into a fibrous coat, sometimes nearly a centimeter thick, and the whole mass with its intestinal covering migrates to the right iliac fossa. The rectosigmoid segment is often 20 centimeters in diameter, and this for a distance of 25 to 40 centimeters, from the peritoneal fold (Perthes') of the first part of the rectum to the descending colon, rarely much farther, while the transverse colon may be dilated and full of liquid fæces, but without hypertrophy or degeneration of its walls.

When the transverse and upper part of the descending colon is dilated, with hypertrophy and degeneration of its walls, I would consider it a case of Hirschsprung's disease.

I hope I have made clear my idea as to the formation of a fæcal tumor in a sigmoid and rectum which was *not* defective at birth.

The cause. At first a little carelessness regarding the bowels with possibly a slight defect in Perthes' fold.

The effect, a megasigmoid forever. Because these mesos will never regain their length and tone, this intestine will never return to its normal size and the walls will never lose their thickness or regain their original elasticity. Under these circumstances new fæcal tumors form, time and time again, each time with more ease, in spite of care on the part of the patient. Please note that I am not writing about "megacolon" "congenital idiopathic dilation of the colon" or "Hirschsprung's disease," a malady of infancy and without doubt very distinct from megasigmoid. Distinct, because 80 per cent of our cases are in persons over 40 years of age, who declare they did not suffer in their childhood from intestinal stasis. I know cases that have suffered from the formation of fæcaloma for 20 years, but not one who had it from childhood.

An inflammation of the small intestine is called "enteritis," of the colon, "colitis,"

of the sigmoid "sigmoiditis," and of the rectum, "proctitis" and no one would ever think of calling them all one disease.

We have reached the era in which we study segment by segment and not the whole. This is the reason why I insist upon calling the disease in question "megasigmoid" or "megarectosigmoid" and *not* "megacolon," as I consider that another disease. I consider "megacolon" as different from "megasigmoid" as laryngitis is from bronchitis.

Pary in 1825, Billar in 1820, Barth in 1870, Peacock in 1871, Chapman in 1878, Gee in 1884, Bristame in 1886, Gaume in 1886, Futterer and Middelfort in 1886, Hughes in 1887, Hirschsprung in 1888–96, Walker and Griffiths in 1899, Consetti, in 1899, Fenwick in 1900, Duval in 1903, Arraga and Zubizarreta in 1905, Castre and Viñas in 1906, Bing in 1907, Bhane and Chaulet in 1908, Finney in 1908, Gaujaux, Chasagnar, Ginard Arauz, Alfaro, Centeno, Arana, Guinard and Cular in 1909–10, Grégoire and Duval in 1913, Palma and Viñas in 1915, and more recently Manuel Galdóz in his thesis of 1916, "Megacolon in the Adult," have all caused more or less confusion by trying to describe two distinct diseases under one name. I have not read the original papers but deduce this from different sources and especially from the Galdóz thesis.

The majority speak of megacolon as a disease of children and not of adults. The ages in Hirschsprung's 10 cases were one of 2, one of 2½, one of 3, and one of 11 months. The rest were between 7 and 10 years (Galdóz thesis).

Duval gives us the following statistics: "four cases properly called congenital, among them Hamann's case (7 months' fœtus); three in which the distention of the abdomen existed from birth; five which, although there was no distention, evacuated their meconium only after 4 or 5 days; thirty-nine cases in which the first symptoms were noticed in the first period of life; four only in adults." Dr. Galdóz, on page 47 of his thesis, goes on to say: "As one can deduce from the foregoing statistics, we are in frank opposition, as far as age is concerned, with the first symptoms of the disease, as in our nine cases, noted in the last 3 years, *all* were in adults; and if we add some more cases known to us, observed in other hospitals of this capital, I think we would come to the conclusion that this disease is evolutionizing, or that in our country, at least, the disease is most frequently found in adults."

I do not believe that there is any "frank opposition" at all. What I think is that Dr. Galdóz very cleverly describes megasigmoid with and without fæcal tumor and that not one of his cases corresponds in any way to Hirschsprung's disease. If there is no name for the disease described by Dr. Galdóz, then it is time to give it one.

If we study one by one the theories advanced by different authorities as to the pathogenesis of megacolon, we will be convinced at once that different authors have described different diseases under one and the same name. In no other manner can I conceive the inconsistency of their deductions.

Some say it is found only in fœtus (Hamann) and children during the first 3 years of life (Hirschsprung), while Duval gives 47 cases at birth or in first months of life, with only 4 of his 52 cases in adults.

In the records of the hospitals of this city during my work here (20 years), there are histories of over 300 cases, all in adults, and our city has a population of only about 250,000. This does not occur here only, for Galdóz reports the same findings as regards Buenos Aires as do also Drs. Viñas and Palma in their communications to the surgical society in that city.

There is another fact of importance and that is that in my cases I have seen only 1 per cent in which the fæcaloma formed outside the rectosigmoid segment (2 cases in 200), but Finney,[1] in 1908, summing up his paper on megacolon, says that up to that time no case had been reported as located in the rectum, and only 30 per cent were in the sigmoid.

Probably the truth is that megasigmoid with fæcaloma as *we* see it, does not exist in other countries, or if it does exist it occurs only rarely, while here with our relatively small population, congenital megacolon is very rare and almost unknown. The microscopical changes in the intestine may be the

[1] Surg., Gynec. & Obst., 1908, vi, 624.

same in both cases, but I do not think this is sufficient reason to consider them as identical diseases. If these patients had had a megasigmoid since birth, not one in a hundred would have reached the age of 45, which is the most common age at which fæcal tumors are found.

For these reasons I beg [illegible] to claim that there is not even a similarity between the two diseases. One is a disease of infancy, the other of adults of middle age; one occurs in the transverse and descending colon, the other in the sigmoid and rectum, only affecting the rest of the large intestine accidentally; one never involves the rectum, the other nearly always.

ETIOLOGY

Megasigmoid is, in all probability, caused at first by neglect on the part of the patient, but once dilatation of the sigmoid and superior rectum begins, there are other factors which help the disease and prevent its easy cure. It is not a congenital or neuropathic factor which produces more megasigmoids in the Argentine Provinces of the interior than in other places, nor is it the water, the difference in food or way of cooking, the grapes with their seeds, the climate, occupations, houses, ways of living or want of healthy exercise. There is no more colitis or enterocolitis here than in any other place. In these provinces there has been a notable absence of water closets. Up to 15 or 20 years ago, a water closet with seat as ordinarily used today was unknown, even in rich men's houses, schools, or public buildings. Outside the towns, the vineyard, behind the barn, the hen-house, or a clump of bushes were the places in which everybody was obliged to defæcate, while in town a hole in and on a level with the floor in a little room at the far corner of the back patio, was the universal water closet. This hole led to a cess pool.

In Europe and North America, both in town and country, there has always been the water closet on more or less modern lines. It is the same in Buenos Aires and the Argentine Provinces.

True it is that squatting down in this way was undoubtedly the original manner in which primitive man defæcated. Had primitive man fæcal tumor? Probably no; the fight for life, more physical exercise, less modesty, and different food relieved him from the bothers of megasigmoid. After extended correspondence with colleagues from all parts of the world, I have come to the conclusion that [illegible] the lack of private and proper places to defæcate are the chief causes for the greater number of such cases in Mendoza.

Every physician and surgeon knows that one of the causes of chronic constipation is the failure to answer the call of nature at the moment. A person has a desire to defæcate and for some reasons does not go to the toilet at once, probably [illegible] day. These reasons are multiplied when there is no water closet within miles. If a young girl has to go to the corral or behind a bush to answer a call of nature, she will not always be able to do so when she likes, but must go when circumstances allow her to do so. Thus is formed the habit of constipation; little by little it becomes worse until it is necessary to take medicine to help the intestine now tired, dilated, and beginning to form an elbow or kink at the site of Perthes' fold, in the first part of the rectum.

Squatting to defæcate must, I should say, increase these kinks when once they are started, the angles become more acute and naturally it is more difficult for fæcal matter to pass, while, especially if there is constipation, the intestine itself has to work harder and the muscular coat begins to thicken with the resultant hypertrophy and later fibrous degeneration.

If, united to these logical common sense causes, the patient begins to take improper drugs (drastic cathartics, etc.), he will get a dilated hypertrophied rectosigmoid more rapidly. If there [illegible] genital defect, in any case, the pathological changes mentioned will come on still more quickly.

Once the megasigmoid is formed, it is only a single step to a fæcal tumor, even if the person is careful. One day the kink is more pronounced, there is too little moisture in the excrement, the little pill or powder has been

forgotten, or easier still, forgetfulness, laziness or want of opportunity has prevented the patient from emptying the bowels for 1, 2, or more days, with the result that he now requires hydraulic power (enema) or manual labor (finger) to empty the bowel. We must also remember that in this stage, there is diminution of reflexes and that these persons have lost, in a great measure, the desire to defæcate. This is one of the most notable features of these cases. Enormous masses of fæcal matter, weighing as much as 8 or 10 kilograms do not produce a desire to defæcate. From any book or physiology, we learn that the presence of fæcal matter in the lower bowel produces the reflexes which awaken the desire for this act, but, as I have said before, in these cases all reflexes are abolished, due in all probability to so often having been left unanswered. Marfan says (Thesis, Galdóz, 52): "Nothing proves that the dilatation is a primitive modification, as it has never been seen in an unborn child; and he considers that megacolon is a modification following congenital constipation, a disease which is closely related to multiple and exaggerated inflexions of the sigmoid flexure." Going on he says: "Stasis of the fæces would be sufficient to explain the series of consecutive phenomena which we observe in this disease. The dilatation is probably due to distention by the gases of putrefaction and, as for the hypertrophy of the walls, this would be at least in part dependent on the chronic colitis analagous to what occurs in the bladder when there is an obstacle to the free passage of the urine."

I believe Marfan had seen and studied a few cases of megasigmoid and not of congenital megacolon. I agree in every way with his hypothesis, and if we find a slight congenital defect in Perthes' fold and much indolence on the part of the patient, we can completely fill the picture.

SEX

The division as to sex is about equal.

AGE

It occurs most commonly between the ages of 35 and 50, is never found in children (my youngest case was a girl of 20, my oldest a man of 85.

SOCIAL POSITION

It is found in all social spheres and without relation to occupation. We see more poor than rich cases. Fæcal tumors are more common in the poor because the rich exercise more care to prevent their formation.

If a well-to-do person has once had a fæcaloma, he will take special precautions and really try to prevent the formation of others; as a rule with success, but he never cures his megasigmoid. The poor and generally indolent, after repeated extractions of fæcal masses, pay, in the long run, for their ignorance and laziness, with their life. In both rich and poor, megasigmoid shortens life.

PROGNOSIS

Megasigmoid without fæcal tumor never improves without surgical intervention. It is not necessarily fatal at once, but without doubt, as I have said above, it shortens life. There supervenes stercoræmia, obstruction, occlusion, volvulvus of the sigmoid flexure, gangrene of the same, perforation — spontaneous or as a consequence of manipulations or drugs for the stasis — peritonitis from that rupture or from a perforation which may be microscopical. Let us consider these in their order.

Stercoræmia or copræmia. This with its sequelæ is the most common outcome of megasigmoid. The condition is always grave and often leads to a fatal result. The absorption from fæcal stasis is pernicious to the general health, bringing on a state of anæmia and cachexia easy to recognize. It is really blood poisoning. The patient has a pale, earthy-colored skin, he loses appetite and flesh, and becomes so emaciated that he looks like skin and bone. The temperature varies from 35° to 41°C., but is low most commonly; it will vary many degrees in a single day. Weakness becomes extreme, the function of all organs is greatly impaired, and death follows in spite of all treatment. While the fæcaloma exists in the rectosigmoid, as a rule, the stercoræmia is not so grave, but the moment it is touched, moved or broken up,

extracted by finger, spatula, or other similar instrument, sterile water, medicated water or oils, the patient grows worse, fever comes on, and very often death results. In other cases and fortunately the most common, after the extraction of the fæcaloma, for a few days the patient has low fever in the afternoon and 35 C. in the morning. He takes castor oil and a daily intestinal wash by enema. With good food and care he is able to go to his home in 8 or 10 days only to return in 6 or 8 months, in spite of all care, with a new tumor. In indolent and ignorant persons the return will be in 4 or 5 months. Some come to the hospital with the fæcaloma and stercoræmia well developed. When this occurs, in spite of extraction, iliac anus, appendicostomy, cæcostomy, etc., death is the general termination.

Obstruction. Total obstruction or occlusion of the intestine is very rare. Gases always pass and generally liquid fæces. In fact, diarrhœa is often one of the first symptoms noticed by the patient when he does not even suspect a fæcaloma. The gases dilate the lumen of the bowel as the fæcal bolus forms, and this is always smaller in diameter than the intestine, for this reason. The occlusion is always due to kinks and without surgical aid the case terminates rapidly. A colleague claims to have relieved a case of occlusion by copious enema.

Volvulus of the sigmoid. I have operated on 9 cases of volvulus of the sigmoid. In two gangrene had already set in. If an operation is not performed in a few hours, death usually follows rapidly. In the cases I have seen, the megasigmoid takes a turn on itself, the meso acting as the center of the circle. In 7 cases there was a half and in the other two a complete turn of the gut. In one of each, gangrene was already present. In all the cases the turn was to the right, the enormous sigmoid passing in front of the rectum. The external border of the sigmoid instead of being in contact with the left wall of the abdomen and occupying the left iliac fossa, was in the right iliac fossa and in contact with the right lateral wall of the cavity. The moment volvulus takes place, there is acute and complete occlusion with the classical symptoms. There is also an enormous tumor in the right iliac and lumbar regions, which corresponds to the greatly dilated (with gas) intestine. Of my 9 cases only 3 were saved. I have seen at least 10 other cases of volvulus, but owing to their being admitted to the hospital in an utterly inoperable condition, no intervention was attempted and seldom was an autopsy done.

Gangrene of the megasigmoid is often a direct consequence of the above and rarely is found after manual extraction of the fæcal tumor. I have seen only one case from this latter cause; without operation it is, of course, fatal.

Peritonitis from perforation is fatal, with or without operation. Theoretically, operating at once ought to save some cases, but when this perforation occurs, the general condition of the patient prohibits intervention. The perforation is caused by gangrene in spots due to the incorrect use of instruments in the extraction of a fæcaloma or possibly by the use of drugs, although I have never been able to prove this latter by autopsy.

Peritonitis without perforation. There is a fatal peritonitis which comes on without perforation after the extraction of fæcal masses. It is caused, I believe, by absorption or filtration of poisons through the walls of the descending and transverse colon which are dilated and very thin and is *not* caused by absorption from the diseased walls of the megasigmoid.

DIAGNOSIS

Usually there is no difficulty in making a diagnosis, as the patient tells us what his trouble is. Occasionally, however, when there is diarrhœa, he does not suspect an accumulation of fæcal matter. The practical man should remember this and never fail to make rectal examination. He will feel a hard tumor in the left iliac fossa or in the middle line, varying in size according to the length of time it has been forming. The consistency of the tumor is pathognomonic; in no other tumors, is it possible to produce palpable indentations in the substance with the examining finger.

Another pathognomonic symptom found in fæcaloma with megasigmoid was first pointed

out to me by Dr. Alfred Metreaux who has also had a vast experience with this disease. If, in the presence of gases around the tumor, between the tumor and the wall of the intestine, the examining hand exerts pressure, the gas adheres to the tumor; on slightly relaxing the pressure one can feel the return of the gas with abrupt separation from the wall often producing a perceptible sound.

Perhaps this is Gersuny's sign mentioned in Keen, *Surgery*, page 655, vol. iv, chapter by Van Hook and Kanavel.

Without the use of the X-ray, the proctoscope, or the sigmoidoscope it is not so easy to diagnose megasigmoid without fæcaloma. To give X-ray specialists an idea, in one case, afterward cured by operation, 4 liters of gum acacia water with 400 grams of carbonate of bismuth were injected into the dilated rectum, sigmoid, and colon without any difficulty and without the patient having the slightest desire to expel it.

I have never had an opportunity of using a modern proctoscope or sigmoidoscope, as used by specialists in rectal diseases. My opinion is that as the greater number of cases, when first seen, have a fæcal tumor and a decided kink or angle at Perthes' fold, the use of such a tube would be dangerous. And again, seeing a fæcal mass would not help either the diagnosis or the treatment.

Differential diagnosis. There are few diseases which a practical surgeon would be able to mistake for megasigmoid with tumor formed or megarectosigmoid: peritoneal bands, volvulus, kinks, intussusception, invagination, megacolon or Hirschsprung's disease, a foreign body in the rectal pouch, uterine tumor, pregnancy, ectopic gestation on left side with bleeding into the peritoneal cavity, or tuberculous peritonitis with liquid. All may, in certain cases, produce obstruction to the passage of fæces and gas; in all of them there would be more or less distention of the abdomen, but it should never be difficult to make a differential diagnosis. In any exceptional cases, if palpation will not clear up the diagnosis, the X-ray would be sure to do so.

Pregnancy with fæcaloma. I have had 5 cases myself and know of 5 more from the maternity hospital and from colleagues. Pregnancy with megasigmoid is a very serious condition. I believe the best thing to do in such cases is to produce an abortion or premature labor the moment the diagnosis is made, and then treat the fæcal bolus and its cause. In the maternity hospital, they have had three deaths from this cause in the last 3 years. The number of mild cases here with accumulation of fæces which yield to soap suds and castor oil treatment is larger proportionally than of those in the maternity hospital of Buenos Aires.

TREATMENT

Medical treatment alone is not only useless but it may cause great harm. In more or less than 60 per cent of my cases, the treatment found in the textbooks in the chapter on "coprostasis" is followed (Keen, vol. iv, p. 656): enemata using different solutions, a gloved finger, dilatation of the rectum at Perthes' fold, and straightening of kink just above, will generally bring the examining index finger in contact with the fæcal mass, which is broken up and hooked out with the same finger, while the left hand is pressed on the abdomen to keep the bolus within reach.

Sometimes the fæcaloma is so hard that the index finger cannot penetrate it. Then the handle of a large tablespoon, spatula, or best of all, one of the blades of a vesical calculus forceps will aid; the operator should always guide the instrument with the finger. Never, never use an instrument without guiding it with the finger and resist the temptation or advice to use any instrument *blindly*. Always remember that the second part and possibly the lower end of the first part of the rectum is thinner and weaker than normal, and that kinks are very easily wounded causing irreparable damage. I consider it much less dangerous to open the abdomen and attack the bolus *in situ* than to use any one of the instruments recommended for use beyond the reach of the guiding finger. Enemata, soap suds and olive oil, are used; another method is trituration, and so on.

Sometimes the patient or surgeon gets tired out. Then the operation can be held over and continued the next day, leaving a

good dose of oil in the bowel. It is surprising what can be done in this way. An injection of morphia just before starting or even rachis anæsthesia is necessary in some patients. I always use novocaine in first or second lumbar space. The anæsthesia makes it easier to push down the fæcal masses within reach. The next day castor oil and daily intestinal washing with sterile water and common salt are given (7:1000). After a week in bed I give medical directions for preventing the formation of another fæcal bolus, and discharge the patient. These are the benign cases, about 60 per cent, where the fæcaloma has formed in the last part of the sigmoid and first part of the rectum, where the mass is not very hard nor the disease of long standing.

In the cases in which the tumor is in the sigmoid and cannot be reached with the finger, I give large doses of opium and belladona to relax the upper rectum. Three days of these drugs combined, with soap suds and oil, have on several occasions allowed me to reach the mass with a finger and conclude the case as cited above. I have been advised to use the whole hand, but have never used more than two fingers. I believe the use of the whole hand, be it as small as you like, is very dangerous and have seen at least one death as an immediate result.

In cases where the tumor cannot be reached with the finger, after the use of opiates and enemata (including 50:1000 sulphate of magnesia, drop by drop), I operate by the abdominal route. The most common operation is extra-intestinal (coprotricia), i.e., trituration of the fæcal masses *in situ* without opening the wall of the gut. In cases where the abdominal walls are flaccid and thin and the fæcal masses not very hard, it is possible, under a general anæsthesia, rachis or chloroform, to break up the tumor without opening the abdominal cavity. I have been able to do this in five cases, once without anæsthesia, with good success, but I cannot recommend it. I believe the open operation is less dangerous and more satisfactory in every way.

The open operation most commonly used by me is that known as Llobet's, first performed by Dr. Andres Llobet about the year 1890 in the Rawson hospital, Buenos Aires. I saw him do it in 1896. He used a mid-line incision, whereas for the last 18 years I have used a left mid-rectus incision through the skin, then turn the rectus muscle inward, and open the abdomen underneath. No muscle fibers are cut. This, I think, makes a better and safer opening without danger of hernia later.

The incision should be long enough easily to admit the surgeon's hand, at least 10 centimeters. I put compresses on each border of the wound. Moynihan's tetra clothes are very good—and introduce my hand in the abdominal cavity. Beginning at the lowest pole of the fæcal bolus, I break off pieces and push them farther along the gut where they are thoroughly triturated, until the consistency of "boiled rice with milk." As this stage is reached, the mass is pushed on toward the lower rectum. Another piece is now broken off and the same process carried out until the whole hard mass has been well triturated and pushed on. The abdomen is then closed, with special care to close the rectus muscle over the inner wound.

Should the patient have been vomiting I inject into the bowel somewhere above the trouble, 30 grams of sulphate of magnesia in saturated solution, using a fine needle and putting a fine catgut stitch in the serosa for more surety.

A dose of castor oil is given the following morning, and the treatment continued as in the simple cases.

I have done Llobet's operation 15 times with 2 deaths, one a week and the other a month after the operation, both from stercoræmia. I have seen more fatal cases in other hands, but statistics in this class of cases are confusing and misleading. If the bad cases which have been sick are operated on after trying perhaps for weeks to get them out by natural outlet, more deaths will result than if only good cases are operated on. Again, if an attempt is made to break up very hard masses through an enormously dilated and diseased intestinal wall, and trauma and hæmorrhages are produced with perhaps gangrenous patches following, the patient is very likely to die. Perhaps the less said about statistics the better. Moynihan

said they could be made to tell anything "even the truth," which is better than another great man who said "they are lies d—— lies." I have done an autopsy on one of these cases and found considerable extravasation of blood in the intestinal wall, undoubtedly produced by too vigorous handling. During operation I have often noticed slight hæmorrhage into the bowel wall which formed small hæmatomata but which have never, to my knowledge, interfered with a good result.

To conclude, Llobet's operation of coprotricia is very good, safe, and convenient, when done without undue vigor in handling the intestine and in cases which are at all operable.

Three times I have opened the abdomen as described, with the intention of doing a Llobet and have found a mass so big and hard and with a chronic megasigmoid and consequently a diseased fibrous wall, that I decided to extract the tumor *en bloc* by opening the intestine. I was afraid that gangrene would follow or serious hæmorrhage into the intestinal wall produced by the forces necessary to break up such a hard bolus. In all these cases the fæcaloma was situated in the sigmoid and encroached on the first part of the rectum. It was the shape of a football and all were about the same size, 50 centimeters in circumference. In these cases the meso is very long and in two I was able to operate outside the abdominal wall. The other was done within the wall. The following technique was used: first, the distended intestine was brought out of the abdominal cavity, tetra cloths were placed around it and the enormous tumor within. Second, an intestinal clamp with rubber-covered blades was attached above and below the fæcal mass to prevent the escape of fluids. If there is any difficulty in placing the clamp, a piece of gauze may be tied around with the same effect, taking care to make the smallest opening possible in the mesentery.

The bowel is opened in the line of its longitudinal band making the incision with a single stroke and sufficiently long to allow the extraction of the tumor without having to touch it. Two hands are then placed under the mass which is easily delivered into the hands of a nurse. This maneuver is singularly easy; if the incision has been properly made, from 22 to 25 centimeters long in my cases, there is no trouble at all and no liquid escapes. The cavity is now wiped out with care and the suture begun. All the coats of the bowel are from 5 to 8 millimeters thick. The mucous coat is easily separated and seems bigger than the fibromuscular coat in which it has the appearance of hanging. Although thickened this coat was friable as in a normal mucosa. The serosa was not changed as the others but was very adherent to the muscular coat, which made the last line of sutures more difficult. Note that the greatest pathological change takes place in the muscular coat, making it thicker, tougher, and decidedly more fibrous.

I used the following method in suturing this long intestinal wound: first, suture mucosa with No. 1 catgut using a Dupuytren continuous stitch with a cross every now and then; second, suture muscular coat with No. 1 silk, Cushing's continuous stitch "Greek border" with the stitches close together and with great care to get perfect apposition; third, make simple continuous catgut suture of serosa over silk suture, letting the needle go into the muscular coat; fourth, place another continuous catgut Dupuytren suture of the serosa inverting sufficiently to hide the last line. The suture of such diseased bowels must always be done with especial care to prevent accidents when the patient has the next bolus which, unless something else is done later on, is a certainty.

The fæcalomata in my cases weighed 560, 640, and 700 grams. All cases were operative successes. Two left the hospital fairly well, while one died a month later as a result of a second operation of which I will speak later.

Formerly, every 2 or 3 months, there would be admitted to the hospital a case of fæcal bolus with accumulation of fæces, occupying all the large intestine. Stercoræmia was well marked. In some I have done a right colostomy and twice I did an appendicostomy, but sooner or later all these cases died. I always use local anæsthesia, but in the presence of stercoræmia any operation gives 100 per cent

mortality. What happens is that once you move or try to move the masses of fæces with any liquid the absorption into the general circulation is greatly increased, and death comes more rapidly. They are really poisoned by their own excrement and cannot withstand even manual extraction. For some years I have given up trying to relieve hopeless cases by surgical means.

Let us consider the cases from which we have removed the fæcal masses and saved the patient for the moment from death by self intoxication. Have we cured him? No! What is to be done? This is the problem. About 1913, I studied seriously all the literature obtainable and could find nothing to meet all the conditions present. In the hospital we tried all the short circuit operations and also total colectomy, following the technique described in the textbooks for them. The Lardenois technique for total resection of the colon is perfect to my mind, as is also that of Sir Arbuthnot Lane, but neither will answer in these cases. The diseased intestine extends as far at least as Perthes' fold, and it is impossible to make an anastomosis which will heal in diseased tissue. The patients themselves have no resistance so far as operations which require a general anæsthetic are concerned. They are not like megacolon (Hirschsprung) or chronic intestinal stasis (Lane); surgically, they resemble cancer of the upper rectum more than anything else generally written about. I believe that, in many cases, the best operation is resection of all the diseased part and either an inguinal or lumbar anus, or else the descending colon should be brought down and passed through the second part of the rectum to the sphincter ani. But there is a great difference between cancer and megarectosigmoid. In cancer the patient is always well nourished, and in good health otherwise to withstand a major operation, or else the case is inoperable (metastasis); while in megarectosigmoid, the patient as a rule is a very bad subject for any operation. His fæces have poisoned him, his flesh heals badly, and his intestine not at all. You can stitch with care, use adjacent serosa or make flaps of it, use the surrounding connective tissue, put a rubber tube high up in the bowel at a great distance from the anus, the utmost care can be exercised throughout, and the result is the same.

I have seen more than one case in which an anastomosis had been done, and the patient [illegible] as 20 days after operation, who suddenly developed an acute peritonitis, and postmortem examination showed non-union causing leakage of intestinal contents.

After bitter experience with a dozen different operations [illegible] formation of fæcal bolus, I finally developed a technique which I have used in a limited number of cases [illegible] original. It is analagous to Moynihan's operation *gastroplication* (Keen, vol. iii, p. [illegible] where I confess I got the idea. It should be called "sigmorectal plication" or "enteroplication."

I have done only 5 cases as yet and there was but one death from an accident not due to the operation. The four successful cases are all in better general health, and by laxatives and enemata which before operation were ineffectual, they can now prevent the formation of new fæcaloma. I am quite convinced that no "plication" operation is perfect in results, but in patients with megarectosigmoid I believe it to be the best, and especially as the general health of the majority of the patients prohibits a more radical operation without an enormous percentage of deaths. Any surgeon interested will readily understand the technique I use by referring to figure on page 946 of Keen, vol. iii. A nurse passes a rubber tube, an inch in diameter and fairly soft, into the rectum after rachis anæsthesia with 15 centigrams of novocaine [illegible] the abdomen is opened through a left mid-rectus incision and the rubber tube passed into the healthy colon; the surgeon guides the tube through the dilated rectosigmoid. This tube is used as a guide in establishing future lumen of intestine and its use makes the "plication" much easier. I use silk for the first lot of sutures and apply them exactly as in Moynihan's gastroplication operation, about 1 centimeter apart, letting the needle go well into the muscular coat but [illegible] the mucosa. With the [illegible]

of a thermocautery I now touch between stitches, going fairly deep. In my later cases I have used the thermocautery before putting in the first row of silk sutures. The object of this is obvious. When all the stitches are in place the tying is finished before I put in the second line of continuous simple catgut suture which covers over the silk knots. Finally I make a continuous Dupuytren catgut suture of the serosa alone which covers in the second line of catgut. The tube is withdrawn and the abdomen closed.

In my five cases the line of suture varied from 10 centimeters in length to 32 centimeters. All included the greater part of the first portion of the rectum. The longitudinal band of the sigmoid serves as a guide to the center.

VOLVULUS OF THE SIGMOID

The surgical treatment of volvulus may be found in any good modern book on operative surgery. I would like to state that I believe few of the authors have seen these cases for themselves but just go on copying the works of others. For example, in the presence of gangrene we are told to cut off the intestine and bring the ends of the healthy colon out of the abdominal wall as is done in the Mikulicz Brunns operation for cancer of the rectum, later closing the new anus by gradually uniting the ends with a special clamp, and finally closing the abdominal wall. These authors forgot that this is quite impossible here as the gangrene extends to the twist which in all my cases was so low down as to make the healthy rectal end too short to reach outside the abdomen. The upper end can be easily detached and brought out, but it is practically impossible ever to do as advised. The best treatment is to bring out the colonic end and close the rectal end; a future operation for uniting might be done. If the patient is in very good condition, the colonic end might be brought down to the rectal pouch or even lower, and an artificial anus need not be made. If there is no gangrene the operation can be best carried out, after reducing the volvulus, as recommended by Braun and Senn, i.e., by fixing to the left abdominal wall and shortening the mesosigmoid by folding it on itself and stitching.

PERITONITIS

Whatever the cause, peritonitis is fatal in these cases and surgery will not only not relieve but in many cases hastens the fatal outcome. Bitter experience has taught me this.

RECURRENT DISLOCATION OF THE PATELLA

WITH REPORT OF SEVEN CASES

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AND

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A NUMBER of factors play important rôles in recurrent dislocation of the patella. Trauma is unquestionably important and frequent in the initial displacement. It is less important in recurrences. There is an inward twisting at the knee together with a blow or pressure on the outer side of the leg, and associated with this is always a strong sudden contraction of the quadriceps muscle.

Recurrent outward displacement of the patella is a lesion peculiar to young girls during their growing period and tends to persist into adult life. Usually the first displacement occurs between the ages of 12 and 18 years and this initial displacement is more painful and disabling than subsequent ones. Injury and excessive knock-knee are the chief etiological factors. The displacement occurs with the strong contraction of the quadriceps muscle, usually early in the act of knee flexion, since in ten to twenty degrees' flexion, the femur easily rotates inward on the tibia and an exaggeration of the knock-knee takes place.

There is a long line of contributing factors which aid these recurrences. Among these are found so many common postural conditions affecting the knee joint that it seems improbable that they alone can be the exciting etiological factor. The most constant contributing factors are:

1. Heredity. Abnormal mobility and laxity of the knee, associated with poor general posture are occasionally hereditary peculiarities.

2. Weakness of the quadriceps extensor muscle with resultant laxity of structures about the knee joint.

3. Static defects. Knock-knee has been long associated with this lesion but the frequency of knock-knee and the infrequent number of slipping patellæ rather weaken this as a strong etiological factor. It is necessary that the outer ridge of femoral condyles be poorly developed. Probably all postural defects act as factors only secondarily through this associated developmental defect.

4. Flat feet give static strain on the inner side of the knee joint and may contribute that additional twist which aids displacement.

5. Elongated patella tendon with relaxed synovial membrane and capsule, both usually due to chronic synovitis. The distention of the joint causes stretching of all the retaining structures.

6. Imperfect development in size and shape of the patella in relation to the external condyle will allow the patella to slip more easily to the outer side.

7. Imperfect development in the size and shape of the external condyle is important. Graser (9) did a supracondylar osteotomy in one case in which he felt this faulty relation required correction.

That the external condyle is occasionally underdeveloped and does not thereby offer a bony resistance to the displacement, is acknowledged by Albee (2) who has used a bone graft to correct this anatomic defect, tilting the outer rim of patellar surface of the femur to block the lateral thrust of the patella.

Of the above lesions, the lateral tendon attachment and the faulty condylar development are the most constant pathological findings. Static defects and capsule relaxation are important in releasing the normal factors restraining displacement.

DIAGNOSIS

The patient usually makes the diagnosis giving the history of (a) severe initial displacement, (b) recurrences, (c) constant fear

Jones knee brace with pad attached.

lest displacement recur—with resultant inactivity.

The initial attack is most painful. The knee is flexed and the patella is found on the outer side of the condyle. Following reduction, expecially in the initial attack, an acute synovitis develops.

TREATMENT

A. *Acute attack.* The treatment of the initial attack calls for immediate reduction of the displacement. This can usually be accomplished by sudden extension of the leg with pressure of one hand against the outer condyle, pushing the patella to the median line. The injury calls for immobilization by means of plaster for 3 weeks, and were this done following the original injury recurrences would be less frequent.

B. *Recurrent attacks.* The treatment of recurrent attacks may be divided into (1) supportive, (2) stimulative, (3) correction of static errors, (4) operative.

1. Supportive treatment in the earlier attacks usually gives the patient confidence. This may be obtained by the use of a split knee cap with a crescentic pressure pad to aid in holding the patella in place or it may require a Jones knee brace with a pad attached (Fig. 1). These should not be used without stimulative treatment, and if used too long are apt to cause varicose veins and œdema of lower leg from constricting straps.

2. Stimulative treatment consists of (a) baking and massage, which will to a degree give tone to the relaxed ligaments; (b) exercises to strengthen muscles and ligaments and to develop postural strength.

3. The correction of static errors is most important. In many of these cases there is marked abduction of the feet (weak or flat feet). This should be corrected in all cases by the Whitman type of foot brace. This correction counteracts in a mild degree a moderate knock-knee. In spite of conservative measures, the knee frequently remains not dependable. In such cases operation should be considered.

4. *Operative methods.* The operative methods are (a) capsulorrhaphy, (b) transplantation of part of patella tendon, (c) transplantation of bony insertion of patella tendon.

Capsulorrhaphy. Alone this operation has been a distinct failure. In conjunction with other procedures, it might be used, provided the length of time of the disability has been such as to cause the inner capsule to relax markedly and secondary deformities to develop. The authors have never done this, however, either alone or in conjunction with the following methods.

Transplantation of part of patella tendon. In the early cases of the authors, this procedure was followed, all cases showing good results. The objections, however, are—

1. Twisting of half of the patella tendon, which, although bringing more tautness between outer side of patella and external condyle, is open to the danger that relaxation of this tendon may take place. In general, a muscle cannot function in two places at once.

2. Splitting of tendon, sewing and handling ends cause them to fray and make it impossible to secure a clean, firm anatomic attachment, whether subperiosteal or into a bony cavity. The patella tendon is surprisingly thin and, on account of this tendency to fray, it is almost impossible to suture. We have, therefore, come to use only the bony transplant operations.

Technique of transplantation of patella tendon (Figures 3, 4, 5, 6 and 7). Usual two-day preparation. Tourniquet.

A curved incision is made from the inner side of the patella well down over the attachment of the patella tendon (Fig. 3). The skin is clamped off with towels. The patella tendon is exposed to view. An incision is made

Fig. 3. Drawing showing line of incision.

patella.

through the thin fibrous covering of the tendon which is then gently retracted and preserved as far as possible for resuture (Fig. 4). An incision through the center of the patella tendon is then made from the patella to the tubercle (Fig 5), cutting it off at this point on the outer half. This half is then quilted with chromic catgut No. 3, turned in under the inner remaining half and sutured in a bony groove as far as possible to the inner side, on the inner face of the tibia (Fig. 6). The periosteum is then pulled over this insertion and the thin capsule pulled over these tendons (Fig. 7). The skin is closed with continuous catgut No. 2. Dry dressing is applied, followed by plaster from the toe to the groin. This plaster remains on for 10 weeks and is followed by gentle passive movements, baking and massage of thigh and calf, and increasing use. (See report of cases by authors, 1, 2, 3, 7, 8, and our cases 12, 14, and 15.)

Transplantation of the bony insertion of the patella tendon. (Figs. 3, 8, 9.) This procedure appeals from an anatomic standpoint as well as being practical and simple. The tendon is neither weakened nor traumatized. There is no suture through tendon and tendon strength is preserved. Results are excellent. (Cases from literature, 4, 8, our cases 13 and 16.)

Operative technique. Two-day preparation. Tourniquet.

A long curved incision is made halfway between the inner condyle and patella, curving over the tibial tubercle. The skin wounds are clamped off with towels and the patella tendon with fascial covering is exposed. A light incision is made through the fascia from the inner border of patella to below the tibial tubercle; this covering is dissected, quickly clamped and retracted to right and left to be resutured later over the tendon. A wedge of bone the size of a thumb-nail is then removed, including the attachment of the inner half of the patella tendon. The patella tendon is split in half and a similarly symmetrical bony wedge removed from the inner surface of the tibia at a point that will take the tendon bone graft. The bony transplant is forcibly wedged into its new bed, the periosteum sutured with fine chromic gut, the light fascial covering resutured, and the skin closed with continuous catgut No. 2. Plaster is applied from ankle to groin and should remain on for 10 weeks. Following this, gentle motions, use, and massage should be conscientiously carried out.

CASE ABSTRACTS

Case 1. K. A. [illegible] Male. [illegible] left knee cap had slipped out of place [illegible] ago, following injury to knee. Recurrence while playing tennis "knee went out" again. Since then this has recurred at intervals. Physical examination was negative except for [illegible]. An attempt to move left patella [illegible]

Fig. 5. Operation for transplantation of patella tendon. Note skin incision and the incision through the fascia covering tendon. Note longitudinal division of tendon.

Fig. 6. Running a line of silk sutures up and down the upper half of the patella tendon.

Fig. 7. Note the external half of the patella tendon has been sutured, passed under the internal half and is sutured subperiosteally. The wound is closed in the usual manner with continuous catgut suture.

apprehensive manner by the patient, especially when it approaches the external condyle. Slight pronation of both feet. X-rays of knee are negative.

Diagnosis. Slipping patella, and operation is recommended.

Operation. Transplantation of the outer half of the patella tendon into the periosteum of the tibia.

Result. Up to March, 1920 (5 years), there had been no recurrence. Perfect function.

Case 2. Miss R., age 17, first seen August, 1912. Fourteen years ago patient fell against an oil stove and pushed the patella out. Since then this has slipped out at various intervals. Physical examination showed very relaxed capsule on the inner side. Any attempt to displace patella is very painful.

Diagnosis. Slipping patella, and operation is recommended.

Operation. Transplantation of the outer half of patella tendon into the periosteum of the tibia.

Result. Perfect function of knee. No recurrence to date (9 years).

Case 3. T. K., age 23, first seen in April, 1918. About 5 years ago following an injury to the right knee, the right patella began dropping to one side. Has been treated with plaster casts, etc. Since the first attack the patella has slipped out seven different times. Physical examination was negative, except for local examination. The right knee is slightly swollen. All motions are limited and very painful. No surface heat.

Diagnosis. Slipping patella, and operation is recommended.

Operation. Transplantation of the bony insertion of patella tendon into tibia.

Result. Perfect function. No recurrence to date (3½ years).

Case 4. I. H., first seen February, 1917. Since childhood has had a weak right knee which often twisted without warning, causing patient to fall to the ground, after which knee would be swollen and very painful. Following a fall, 3 years ago, right knee has been limited in motion. Physical examination was negative except for local condition. The right knee is swollen and tender. Patella approaches outer side of knee. Extension is normal, flexion is painful and limited. The patella slips to outer side of knee when knee is flexed. Some grating under patella on motion.

Diagnosis. Slipping patella, and operation is recommended.

Operation. Transplantation of bony insertion of patella tendon into inner side of tibia.

Result. Good function, no recurrence. January, 1921: "On the whole it seems to be greatly improved. There is no slipping of the knee-cap and, although it is somewhat weak and occasionally wrenches enough to throw me, it does not hurt as it used to and no swelling follows. I have a little more than half motion, but do not limp at all."

Case 5. A. C., first seen June, 1911. Fifteen years ago patient fell through a piazza, striking on left knee. Since then has had attacks of patella slipping toward the outside of the knee, causing extreme pain and discomfort often lasting several hours. Last attack 2 years ago and since then knee-cap has been very loose. Physical examination shows left patella freely movable and can be carried well beyond median line on outer side.

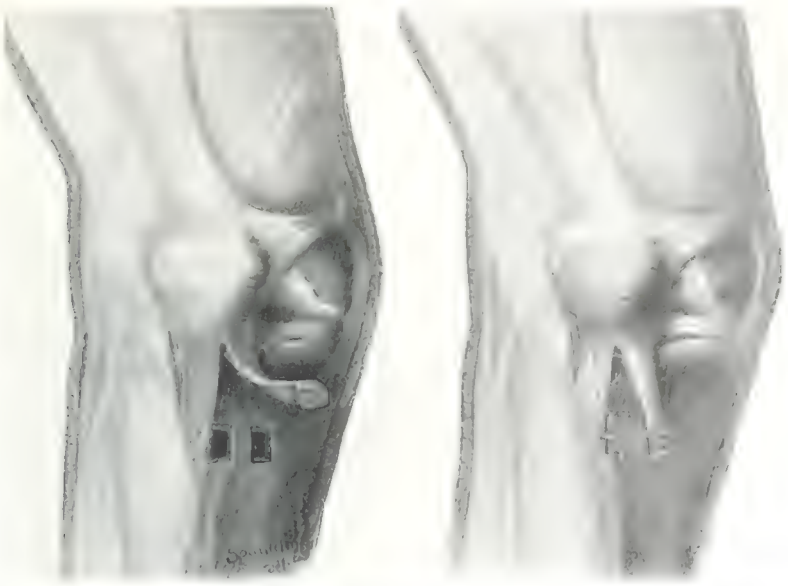
Diagnosis. Slipping patella, and operation is recommended.

Operation. Capsulorrhaphy (by another surgeon).

Result. (?) Case has been lost.

Case 6. W. T., first seen July, 1906. Four years ago patient fell, striking on the outer side of the left foot, bending the knee inward. After that the knee has often "given out from under him." Feels insecure and has been wearing knee-cap and bandage.

The patella tendon is loose and attached toward the outer side of the median line of leg. It is also tilted down to the outer side of the knee. The



Figs. 8 and 9.—Showing method of transplantation [illegible]

internal condyle is prominent. The leg cannot be fully extended and there is slight crepitation under the patella.

Diagnosis. Slipping patella, and operation is recommended.

Operation. Transplantation of the outer half of the patella tendon into periosteum of tibia.

Result. Not satisfactory. Previous operation did not accomplish all that was desired so about 8 months later a rotation osteotomy was done just above adductor tubercle, the condyles being placed in their normal relationship. This operation resulted in normal function of the knee

CASE 7. B. D., first seen July, 1908. Knees have always turned in. Left knee has "given way under her" when walking. Has had several attacks during the last few years. Physical examination shows knees in semi-valgus position. There is also about 5 degrees' lateral mobility in full extension. Both patellæ are abnormally movable. The tibial tubercle is congenitally misplaced, being nearer the external edge of tibia than is normal.

Diagnosis. Slipping patella, and operation is recommended.

Operation. Transplantation of outer half of patell[illegible] into periosteum of tibia.

Result. Immediate result good but patient has since disappeared.

CASE 8. J. M., first seen November, 1904. About 12 years ago patient's knees began to "give way" from beneath her. The attacks came suddenly and she would fall. These occurred at intervals of weeks, always associated with swelling of the knee and "it always felt as if something came out from the inside of her knees." Physical examination was negative, except for [illegible] normal. On complete flexion the patient [illegible] toward outer aspect of knee. Patient has a slight knock knee.

Diagnosis. Slipping patella, and operation is recommended.

Operation. Transplantation of the outer half of patella tendon into periosteum of tibia.

Result. Normal function. No recurrence to date 17 years.

CASE 9. Mrs. T. C. K., first seen March, 1912. Patient has had trouble with her feet for years. At the age of 10 years her left knee began to slip out at frequent intervals. Six years later her knee was operated upon by another surgeon, a reef being taken in the capsule. The knee remained fixed for 2 years when it began to slip out again in spite of the leather braces and knee-caps he had been wearing.

Diagnosis. Slipping patella.

Treatment. Capsulorrhaphy (by another surgeon).

Result. Failure.

CASE 10. A. B. first seen August, 1913. About 20 years ago [illegible] dislocated [illegible] for the first time. This has since recurred at frequent intervals. Four years ago [illegible] operated upon for this condition. Several hours [illegible] ago the patient tripped, fully flexing the knee. The patella was displaced laterally forcing the external condyles through the lateral capsule. The tear being near the patellar tuberosity, the most of the ligamentum patellæ tendon is intact.

Diagnosis. Recurrent dislocation of left patella and ruptured internal lateral ligament.

Treatment. Light [illegible] Operation [illegible]

Result. Good function.

SUMMARY OF AUTHOR'S CASES

No.	Name	Age	Occupation	Injury	Diagnosis	Treatment	Result	Remarks
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Tendon transplantation	Good	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Tendon bone transplantation	Good	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	Twist	[illegible]	Tendon bone transplantation	Good	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	?	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Tendon transplantation	Poor	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Tendon transplantation	Poor	Immediately after operation.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Tendon transplantation	Good	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Conservative. Capsulorrhaphy	Poor	[illegible] previously operated upon by another surgeon and [illegible] without improvement.
[illegible]	[illegible]	[illegible]	[illegible]	None	None	Conservative	Good function	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Conservative	No improvement	Operation later
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Good function	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	Twist	None	[illegible]	Excellent	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Tendon transplantation	Function normal	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	None	None	Tendon transplantation	Function normal	No recurrence
[illegible]	[illegible]	[illegible]	[illegible]	Contusion	None	Bone transplantation	Function normal	[illegible]

CASE 11. Mrs. T. S. M., first seen October, 1919. For the last 24 years both knee-caps have been slipping out. These attacks come on very suddenly and are very painful. The patient has been wearing supports for the knees. Physical examination shows both feet slightly flattened with a moderate hallux valgus. The patient is wearing very tight split knee-caps which are causing swelling of the lower legs.

Diagnosis. Slipping patellæ (double).

Treatment. Conservative. Operation later.

Result. No improvement. Refuses operation and still has recurrent displacements.

CASE 12. E. H. T., first seen October, 1904. About 4 years ago, patient fell on knee and was confined to bed for a month with leg in splints. Two and one-half years ago she fell again, and remained in bed 2 months. Three months ago, she again fell and had to push patella back in place. Cast worn one month. Physical examination negative except for local condition. The entire musculature of the right leg is flabby and the power in this limb is considerably diminished. Both patellæ are more movable than normal.

Diagnosis. Slipping patella, and operation is recommended.

Operation. Transplantation of outer half of the patella tendon into periosteum of tibia.

Result. Function normal. No recurrence to date.

CASE 13. L. D., first seen November, 1919. Five years ago patient twisted the left knee. Laid up a week. One year later fell again, this time striking on the right knee. A year later her knee slipped out five or six times, always accompanied by pain and swelling. Physical examination shows a moderate amount of fluid in the right knee and any attempt to push the patella to the outer side is very painful.

Diagnosis. Slipping patellæ, and operation is recommended.

Operation. Transplantation of the bony insertion of the patella tendon in tibia.

Result. No recurrence, excellent function; no subjective symptoms.

CASE 14. L. A. S., first seen October, 1911. Nine years ago the patient injured the knee which became swollen and painful. Patient was unable to walk. Knee-cap has slipped out twice in the last 2 years. Physical examination shows patella unusually mobile. Can almost be thrown off to outer side with ease.

Diagnosis. Slipping patella, and operation is recommended.

Operation. Transplantation of outer half of patella tendon into periosteum of tibia.

Result. No recurrence. Function normal to date.

CASE 15. M. H., first seen November, 1908. Left knee-cap has slipped out many times within the last 3 years. Physical examination was negative except for local condition. Left knee is moderately swollen. Fossæ on either side obliterated. Slight increase in surface temperature. Complete extension of knees possible with difficulty. Both patellæ tendons are elongated, those on the left more than the right. Tibial tubercle is external to mid-line of patella; the pull of the patella tendon is, therefore, obliquely outward, the patella being tilted.

Diagnosis. Slipping patella, and operation is recommended.

Operation. Transplantation of outer half of patella tendon into periosteum of tibia.

Result. No recurrence. Function normal.

CASE 16. Miss M. H., age 28, first seen August, 1920. In 1915, patient struck right knee against a chair sustaining an injury which kept her in bed for

6 weeks. After that she was unable to use the knee even with a knee-cap and "it kept slipping out." Following each attack she was "laid up" from 6 to 8 weeks. Last attack July [illegible] following which she was confined to bed until September 6, 1920. Physical examination was negative, except for condition of right knee, which is swollen. All motions are painful, especially on moving the patella outward.

Diagnosis. Slipping patella, and operation is recommended.

Operation. Transplantation of bony insertion of patella tendon.

Result. Excellent function.

BIBLIOGRAPHY ABSTRACTS

Goldthwait in February [illegible] reported a series of slipping patellæ with the following results: 1 case where tendon was transplanted with its bony insertion with good result; 5 cases where tendon was transplanted into periosteum with good result; 2 cases where tendon was transplanted into periosteum, not good result; [illegible] where capsule was quilted with not good result.

Krogius in *Zentralbl. f. Chir.*, Mar. 5, 1904, reported 2 cases, one double, where patella was held outward by tense outer portion of the capsule. He operates as follows: (1) approach the knee by Kocher incision [illegible] from slightly above the patella, down a few inches in front of its outer edge to insertion of ligamentum patellæ; through the iliotibial band, tendon of vastus externus and fibrous capsule; (2) formation of a bridge-shaped flap on inner side of patella connecting below with the tendinous expansion of vastus internus and fibrous capsule and above with muscle and fascia; (3) transplantation of the flap, left attached at both sides across patella at its outer edge.

Result. First case: after 6 months patella slipped out again. Second case: result perfect after 3 months.

Whitlock in *Brit. [illegible] Surgery*, July [illegible] gives technique as follows: (1) freeing external side of capsule with or without opening joint; (2) transplanting insertion of patellar ligament medially; (3) reinforcing the patellar ligament by grafting tendon of gracilis into it.

Dumferline in SURGERY, GYNECOLOGY AND OBSTETRICS, April, 1912, describes his technique as follows: patellar ligament is split, portion is turned up and sutured to the cut end of the tendon of the semitendinosus with chromic catgut. Capsule and fascia are then reefed.

Murphy's technique is given in Murphy's *Clinics* vol. iii, No. 4, August, 1914, as follows: Joint exposed freely by two longitudinal incisions, one on either side of the patella, turning the patella with the ligamentum patellæ to one side. Segment of bone between condyles removed to deepen the groove. Flap of fat and fascia then turned in from above and sutured over the denuded bone area to prevent ankylosis of patella to femur. Patella then replaced.

Graser in *Deutsch. Ges. f. Chir.* [illegible] July 9, 1904, reports a case where outer condyle stood considerably farther backward than inner condyle when leg rotated outward. He operated by means of supracondyloid osteotomy [illegible] and rotated the condyles so as to bring outer portion forward and inner condyle farther back.

Albee in *Orthopedic and Reconstruction Surgery*, describes his technique as follows:

"A semilunar skin incision [illegible] of the patella sufficiently large to expose the tibial tubercle and to a point above the external condyle. Avoiding undue disturbance of the underlying joint structures, [illegible] making a bone incision from [illegible] lows the anterior surface of the external condyle to be elevated to a plane above the internal condyle, by producing the object being to place a permanent and rigid [illegible] ward displacement of the patella.

With [illegible] desired obstructing effect, the width of the bone-gap thus [illegible] to fill this cuneiform opening is removed from the [illegible] the tibia through the lower portion of the original [illegible] This bone-graft wedge can be easily and quickly procured by [illegible] it is drilled obliquely in one or two places with a motor [illegible] external condyle after it has been put in position. Dowel pins made [illegible] from the crest of the tibia at the time the graft is obtained, and rounded by the motor-lathe to fit the drill holes in the [illegible]

[illegible] encountered, the motor-drill can again be inserted into the [illegible] the external condyle. The ligaments and tendinous expansions are sutured over the graft with kangaroo tendon, thus securely holding the elevated portion of the condyle. [illegible] of [illegible] groin is encased in a plaster-of-Paris splint in which it is allowed to remain for 3 weeks; at the end of this time [illegible] tion of adhesions, and that the permanent blocking of any further tendency to displacement of the patella is effected by the actual elevation of the external condyle or an actual [illegible] tion of the normal mechanico-anatomical conditions. [illegible] nal capsular ligaments is their plication with kangaroo tendon; this, however, is usually unnecessary, for if the external condyle is propped well forward, all requirements are fulfilled."

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AN ENDEAVOR TO EVALUATE CHRONIC SEPSIS IN PREGNANCY

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PART I

THE study of acute infectious disease has shown that certain types of bacteria which gain entrance to the body cause a sequence of clinical symptoms which may be said to describe the type of the invading organism. In most of these disease entities the moment of invasion is a silent moment, followed by a period of incubation, ending in symptoms which go to make up the particular disease entity. There are many of these clinical entities. In some cases the invading organism is known, in others it is unknown. The definition of the clinical entity is not, however, dependent on the isolation of a definite bacterium.

In the following paper I wish to describe a clinical entity, apparent in pregnancy, which has chronic sepsis as its etiological basis. This clinical entity instead of describing a definite bacterium shows plainly that it is produced by many different kinds of bacteria. It is the singleness of the principle involved which demonstrates the entity. The manifestations like the bacteria involved are multiple.

In the study of disease the importance of the point of entrance of bacteria and the moment of invasion has been emphasized by MacKenzie in his book on the *Future of Medicine* (1). With the knowledge we have of the damage done to the human system by the invasion of acute infections, it is difficult to understand why the importance of an area of chronic infection, however small, is so little appreciated. If we regard an area of chronic sepsis purely as a point of entrance of bacteria within the system, the sequences which may follow can not be less harmful than those from the point of entrance in an acute invasion, provided it is admitted that the bacteria contained in the area of chronic sepsis can migrate to other parts of the body. Then the analogy becomes complete. Acute tonsillitis never killed any one, but it is the endocarditis or what not, that is the sequence of the tonsillitis, which kills. Just so the chronically infected tonsil or the abscessed tooth root does not kill, but in its primary element as a point of entrance of bacteria it has the same potential characteristics. That bacteria contained in these areas of chronic sepsis do migrate is too well settled today to warrant further discussion.

It is my belief that obstetrics offers a better opportunity for the study of the effects of chronic sepsis than any other branch of medicine. This belief is based on the conception that the processes involved in pregnancy act as the most severe physiological function test that the human system has to endure. As such it tends to bring out the previously existing weak points in the individual. It uses up a part or the whole of the reserve power of the different organs involved and thereby shows the defective organ when the reserve power of that particular organ is exhausted. I believe that the additional load of the pregnancy actually lowers the resistance of the maternal organism, if it is attacked by infection and that the effects of chronic infection already in the system are made more evident as a result of this reduction of the total bodily resistance. The high mortality among pregnant women in the influenza epidemic is consistent with this conception. The aggravation of many previously existing pathological conditions is also consistent.

With this conception as a foundation, already existing infection in the pregnant woman becomes of importance. Not only is it important in the individual pregnancy but also in the patient's whole obstetrical history. In drawing a conception of the effects of chronic sepsis in pregnancy, it is necessary to conceive of a clinical entity which covers months and years, since the etiological factor is often present for a like period of time. A great diversity of manifestations is likewise to be expected. In both of these characteristics the analogy to syphilis, the best under-

stood of the chronic infectious disease entities, is apparent.

Syphilis shows us that the chronic infecting agent can be persistently present in the system without causing symptoms of sufficient seriousness to send the patient to the doctor, yet this same infecting agent can show damage in some form which is often apparent only in pregnancy. The baby born with spirochætæ in its liver received those spirochætæ from its mother's blood stream and it doesn't matter whether the mother had the symptoms of syphilis or not.

What are some of the more common complications which confront the obstetrician? Toxæmia of pregnancy in its many forms is by far the most common and most important. Of this I shall speak later. Breast abscesses, non-suppurative mastitis, pyelitis, phlebitis, with an occasional pulmonary embolus are ever present dangers which must be constantly kept in mind by the obstetrician. These complications all have the common etiological basis, infection.

When it was first discovered that the typical case of puerperal septicæmia was due to extraneous infection, that is, that the infection was introduced at the time of delivery, the opinion naturally arose that all other infectious complications were the result of infection introduced from outside. As a sequel it has been universally believed that the breast infection was the nurse's fault in not keeping the nipples clean, that pyelitis was due to an ascending infection from urethra to bladder and thence along the course of the ureter to the pelvis of the kidney, and that phlebitis was thought to be universally due to parametritis with direct extension to the femoral vein.

There is much evidence available which tends to qualify this former conception if such cases are viewed from a broader standpoint. If we consider breast abscess as an infection of hæmatogenous origin and regard this abscess merely as one manifestation of a larger entity, chronic sepsis, the truth of the situation is more apparent. If we cease to regard the breast abscess as a complete clinical entity and view it as a symptom, a manifestation of the presence of occasional septic emboli in the blood stream, it will soon be apparent that many such cases will [illegible] other evidences of septic emboli or the effects of chronic sepsis in the system.

For instance, a patient had several non suppurative mastitis attacks in her first pregnancy and these were *repeated in her second pregnancy*. She gave a history of frequent tonsillitis and had several attacks while under my charge. Physical examination showed two large diseased tonsils and a mildly decompensated mitral stenosis. There was a mild toxæmia present at the end of her first pregnancy.

The chronic endocarditis speaks for blood-borne infection in the past, probably originating in the tonsils and the repeated breast attacks in two pregnancies (always associated with high fever and malaise) point to blood borne infection at the present time. The toxæmia is also a part of the picture.

Phlebitis, which is essentially a periphlebitic process resulting in thrombosis, is seldom unattended by other manifestations of hæmatogenous infection, past or present.

Pyelitis has been an ever-increasing complication of pregnancy in my own experience, and it has been impressive to note the number of such cases which present the history of pustular eruptions or furunculosis both before and after the appearance of the pyelitis. In such cases the pyelitis is merely an incident, a boil in the pelvis of the kidney. It is granted that these several complications of pregnancy are also sequelæ of infection when introduced from outside, but it is my contention that this sequence is merely clinical proof of the principles involved in the larger entity of which a focus of chronic sepsis is the continuous etiological factor.

With the conception clear in mind that a focus of chronic sepsis does throw off bacteria into the blood stream, not as a bacteriæmia or septicæmia, but as a series of bacterial emboli, it will be seen that the placenta, an organ constantly bathed by the maternal blood, is continually exposed to attack by these septic emboli, and therefore becomes an organ of great importance.

As a removable organ, it should present on its surface a record of damage done to it by

Fig. 1. Fig.

these septic emboli and these points of damage should have a chronological relationship to clinical evidences of acute infection elsewhere in the body. In a previous paper [2] I have submitted evidence that the infarct is infectious in origin. I also maintain that there is a chronological relationship between the time when the infarct is originated and the activity of sepsis, either acute or chronic elsewhere in the body. This point is so important that I desire to be more explicit.

The method of determining when an infarct originated, that is, the time in the pregnancy, can be determined in the case of infarcts which are on the edge of the placenta.

The normal placenta enlarges concentrically with the point of cord attachment in the center. During the growth of the placenta an injury to the edge (infection followed by localized thrombosis) stops the growth or enlargement of the placenta at the point of injury. Such a process results in an asymmetrical placenta. In the asymmetrical placenta the edge farthest from the base of the cord is the last placental tissue grown. In the normal placenta the whole circumference is the last tissue produced. In the asymmetrical placenta, by dividing the distance from the base of the cord to edge of placenta farthest away, the radius of a circle is found which would roughly represent the circumference of that placenta at 4½ months.

The position of the infarct within or without this circle will determine roughly the time in the pregnancy when it began, if it is on the edge, or, when it is in the middle, the time after which it must have occurred.

For instance, an infarct on the edge, Figure 1, *a*, at 3 months which stops the growth of the placenta at that point can not have occurred later. An infarct occurring at point Figure 1, *b*, could not injure the placenta at that point until the placenta had enlarged to that size which would from its position mean later than the middle of pregnancy. Likewise if an infarct occurs in the middle of the placenta at Figure 1, *c*, this injury may have occurred at any time subsequent to the growth of that part of the placenta which from its position in the diagram can be roughly estimated from 3 months on.

By observing the course of the blood vessels on the fœtal surface of the placenta, this method of growth of the placenta and the results of infarct formation on its edge can be demonstrated.

Figure 2, a diagram of the placenta in one of my cases, is an example. Figure 2, *a*, infarct formation which occurred within first 3 months and stopped further enlargement along the edge. Figure 2, *b*, infarct formation on edge of placenta shortly after the middle of pregnancy. Figure 2, *c*, a tongue of good placental tissue which grew out and around the edge damaged by infarct, Figure 2, *b*. Figure 2, *d*, course of blood vessel which originally pointed to region covered by *b* but changed its course to supply the tongue of placental tissue *c*, showing that placental tissue *c* grew subsequently to the infarct formation at *b*. Figure 2, *e*, enlargement of the placenta in asymmetrical formation to compensate for its inability to enlarge concentrically at region *a*.

This case demonstrates that infarct formation when on the edge of the placenta stops the growth of the placenta at the injured point. The position of these infarcts as noted was chronologically coincident with clinical symptoms in the patient's pregnancy.

Case 1. Primipara. Acute appendix removed August, 1918. Last period March 3, 1919. On April 1, 1919, there was slight bleeding which continued for several days. May 2, 1919, nausea, specks before eyes, and dizzy spells. June 1, 1919, another bleeding spell of one day duration. Dentist had been treating a devitalized tooth twice a week preparatory to filling nerve canals. Last treatment 3 days before bleeding began. X-ray showed an apical area. During the last part of August, 1919, she had an acute throat with white patches on tonsils.

Vomiting continued until motion was felt. Occipital headaches, specks before eyes, and œdema of legs until the the seventh month. October 28,

septic tooth extracted. November 10, no more specks or headaches. Sleeps better, feels better, œdema less. December 6, normal delivery of 7-pound baby. There was no rise of blood pressure or urinary disturbance throughout pregnancy

The stirring up of the septic tooth chronologically preceded the bleeding in the early months of pregnancy and with the infarct formation at *a*, Figure 2. Infarct *b*, Figure . was formed also coincident with the attack of tonsillitis in August. No external bleeding, however, resulted. Toxic symptoms subsided after extraction of septic tooth. For other evidence of hæmatogenous infection in system, note appendicitis in August, 1918.

The following case had best be entered here on account of the similarity in the etiological factor.

Case 2. A primipara had her last period on December 25, 1920. January 20, 1921, she had the sensation of approaching menstruation but did not flow. January 28, 1921, went to dentist who opened root canals of septic tooth preparatory to treating. X-ray film taken on that day showed wire in nerve canal and penetrating apical area. Also shows apical area on tooth adjacent. February 1, 1921, felt fullness in pelvis, had headaches and dizziness, and lost appetite. February 8, 1921, the untreated septic tooth was extracted. Symptoms during February: Three severe headaches associated with specks before eyes and blurred vision, nausea without vomiting. March 1, 1921, these symptoms stopped suddenly. March 16, 1921, first seen by me, at which time she felt perfectly well. Vaginal examination revealed a soft uterus, still in the pelvis in good position but not as large as the date would signify. March 23, 1921. Miscarried and was curetted at her home by another doctor who told her that he thought the pregnancy had been dead some time. Her tonsils had been removed in 1910.

Patient was a trained nurse and her observations reliable. The sequence of events in this case is most striking. The stirring up of the focus of sepsis undoubtedly threw bacteria into the blood stream which reached the placenta, injuring it sufficiently to terminate the pregnancy gradually. The cessation of symptoms suddenly about March 1 probably marks the time of the termination of the life of fœtus. I have seen a similar event in two cases of death *in utero* in a severe toxæmia at $7\frac{1}{2}$ months. The miscarriage did not represent the time of the termination of the pregnancy but merely the casting off of the already dead fœtus.

Case . A [illegible] pregnant [illegible] bleeding which lasted five days.

Case . A primipara [illegible] Left femoral phlebitis also appeared on the tenth day after delivery with an afebrile convalescence [illegible]

These two cases are cited to show the sequence between infection in throat and uterine hæmorrhage. Both of these cases occurred previous to my association of these events with infarct formation and the placentæ were not observed when they were delivered at full term.

Case . A [illegible] in glands at angles of jaw and malaise *without inflammation* of surface of tonsils) followed by miscarriage and curettage ten days later.

In this case the damage to the placenta by the infection was sufficient to terminate the pregnancy.

Case 6. A primipara [illegible] larger than left) and one devitalized tooth with history of [illegible]. She had [illegible] bleeding at $2\frac{1}{2}$ months. Placenta was of the asymmetrical type with cord attached near edge and infarct formation along this [illegible]

No clinical event associated in her memory. Patient not seen until eighth month.

Case . A multipara [illegible] weeks after her last period. No clinical event associated. Placenta was a typical asymmetrical battledore type. Patient had an enlarged heart with thrill and systolic murmur at apex. Tonsils diseased. Blood pressure [illegible] severe [illegible] months she [illegible] pulsation [illegible] preceding last [illegible] months. Had a bleeding spell [illegible] first pregnancy also [illegible] during the [illegible] pregnancy.

Although there was no clinical event associated with the bleeding in this case, her past history with the heart damage shows evidence of a previous blood-borne infection with the tonsils, the most probable etiological factor, still present. The bleeding spell was recorded by the shape of the placenta.

Case 8. A multipara whose last period was July 1, [illegible] November 2, 1920. Her placenta showed a large

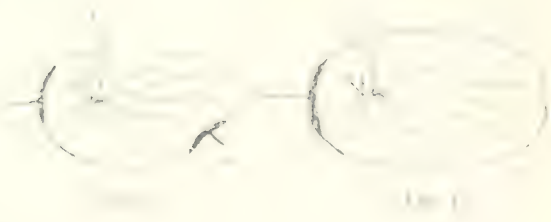

Fig. 4

nfarct on the edge at about 4 months. No history of bleeding.

throughout this pregnancy. Had a lot of trouble during this pregnancy with a painful carious molar. ral months after the birth, when she had a miarriage of twins on the next day. Bleeding had been present before the extraction, how

Another miscarriage came in February, 1919. Her had tonsils in 1920 when I attended her.

This case raises the question which was the cause of the trouble. The severe cold was associated with the infarct in her last preg pregnancy without any septic teeth being present. The activity of the tooth in association with the vomiting in the first pregnancy and the first miscarriage tends to connect these events with the tooth. The second miscarriage might well have come from the clipped tonsils, which are notorious sources of chronic sepsis. The case demonstrates one important principle in the relation between treatment and results. The eradication of chronic sepsis must be complete to get results.

Case 9. A primipara with large tonsils, the right and stiff joints had a bleeding spell on February 8, I had the satisfaction of making a note to look for the infarct at the time of birth, and it was there on the edge in the proper position in the placenta at No clinical event was associated with infarct *b*, Figure 3, which must have occurred at

First baby July, 1917. Baby died in 5 days of hæmorrhagic disease. Weight 4 pounds, 11 ounces. Full term. March, 1919, miscarried at 3 months. March 5, 1920, complaint, cannot get pregnant. She had a mild leucorrhœa which responded to treatment. May 11, 1920, blood pressure found to removal of abscessed tooth, pimples on face

took place in September, 1920. During latter half of October the remaining dead after treatment December 2, considerable pinkish mucus from vagina followed by a thick mucoid leucorrhœa.

Note made to look for infarct at 3½ months. It was there resulting in a placenta shaped as diagram. Baby weighed 9 pounds, 4 ounces.

The small full-term baby which died of hæmorrhagic disease followed by a miscarriage was all subsequent to the history of the abscessed dead tooth. The cessation of the pimples on her face after the removal of this tooth suggests the removal of the source of the hæmatogenous infection. The infarct formation at *a*, Figure 4, can be attributed to the closing of the questionable dead tooth, as it is associated in time.

Case 11. A primipara whose early pregnancy was not marred by nausea or vomiting and whose teeth were above reproach, had a severe attack of influenza at the end of her sixth month. For several days after, false labor complicated the situation. An acute pyelitis made its appearance 4 days before delivery, resulting in a birth 2 weeks premature. Figure 5, *a*, shows a ring of infarction and margin of membrane attachment. *b*, Shows edge of placental tissue. The placenta was of the typical circumvallata type, the edge of attachment of the membranes being about 2.5 centimeters from the true edge of the placenta. The baby weighed 6 pounds. The cord was attached to the center of the placenta.

Here is a case where the severe infection nearly terminated the otherwise normal pregnancy as evidenced by the false labor which followed. The reason is plain when we find the whole circumference of the placenta *as it was at the time* of the infection, infarcted. The only thing that saved the pregnancy was the persistent growth of the placental tissue, not from the injured edge but from the maternal surface within the edge which raised the infarcted edge plus the margin of membrane attachment away from the uterine wall resulting in the typical circumvallata formation.

Case 12. Another case of severe bronchial infection was followed by a pinkish leucorrhœa which continued 2 weeks. The placenta showed an infarct which corresponded to 8 months at which time the infection and discharge occurred. Note also made in this case to look for infarct formation and it was there.

Case 1. First seen [illegible] Primipara. Last period October 13, 1920. Appendectomy in 1914. Prompt recovery.

During first week of March, 1921, patient had influenzal attack. She was in bed 3 days at the end of which time she began to have a pinkish watery discharge. This was about 4½ months. This watery discharge, later colorless, was continuous until June 9 (7½ months) when labor began. She was delivered of twins. First twin weighed [illegible] pounds, second 2 pounds. Second twin died in [illegible] 20 minutes. First twin died on third day of hæmorrhagic disease. It was not necessary to rupture the membranes of the second twin.

The difference in size of the twins was apparent from the size and condition of the placentas. The placenta feeding the second twin was only one-third of the total surface and this smaller placenta not only had its whole margin infarcted but was thoroughly studded with infarcts. There were a few small infarcts in the middle of the larger placenta.

In this case the inflammatory reaction of the infarct formation associated with the influenza attack undoubtedly resulted in the rupture of the membranes of the upper sac containing the second twin. This explains the continuous hydrorrhœa for 3 months and the absence of the sac of liquor when the second twin was born. The injury done to this one placenta undoubtedly accounts for the smaller size of the second twin.

This case is particularly illuminating in view of the case of twins recently reported by J. W. Williams of Baltimore (3) in which one twin was syphilitic and the other not. He cites this case as being consistent with Colles' law, and to support this view suggests that the husband (not syphilitic) was the father of one twin and by calling on the principle of superfœtation and Colles' law he made the syphilitic twin the child of a syphilitic lover.

The case I have cited offers a far more reasonable explanation. It is not so very uncommon for a woman with no signs of syphilis and a negative Wassermann to have a syphilitic baby. The placenta of the child's liver have got to come from [illegible] but if we conceive of a focus of spirochætæ somewhere in the mother which threw off a [illegible] of one twin and not in the other and no more emboli followed, we have a much more reasonable explanation of the case than the [illegible] with [illegible]. The infarct is a localized point of infection and as [illegible] hæmatogenous [illegible]. It is a [illegible] bacteriæmia or septicæmia the lesions would be multiple more often. Likewise if a breast abscess was due to a bacteriæmia, the [illegible] would be multiple [illegible].

In the case cited the placenta of one twin was [illegible] interference with the result that it was prevented from enlarging to compensate for the needs of the growing fœtus. Its surface was also damaged, reducing the total available feeding [illegible] placenta. Hence the discrepancy between the weights of the twins.

[illegible] quinsy sore [illegible] dentist declared were all [illegible] had a slight bleed[illegible]

[illegible] r, dizziness, blurred vision and heartburn. January 20, her whole [illegible]

other bleeding spell. There was no rise of blood pressure throughout. In this case I made the note to look for a battledore placenta with another infarct to be situated about 5 inches from the base of the cord. Figure 7 is a diagram of placenta delivered. *a*, Represents the infarct which corresponds to the bleeding attack in the first month in June. *b*, represents the infarct which corresponds to the bleeding at the eighth month, in January. No other infarcts were visible to the eye. Normal delivery of 8-pound, 6-ounce baby.

It will be noted that in several of the previous cases, vaginal discharge with or without bleeding is associated with infarct formation. In this case the vagina became inflamed before the bleeding occurred, in others the bleeding came first. The onset of vaginal discharges (the discharge coming from the cervix associated with marked reddening of the vagina and itching) has been a more or less frequent occurrence in my practice. My present view of this symptom is that it results from the drainage of the septic serous discharge which originates in the early infarct formation. If the discharge is sufficient to dissect its way down between the chorion and the uterine mucosa to the cervix, it inflames the cervix and vagina. Bleeding may or may not accompany this symptom, dependent on its amount. One of the ward cases gave a history of slight bleeding about 2 weeks before delivery. When the placenta was born, an area of bleached out blood clot the size of one's hand was adherent to the membranes and extended from the edge of the placenta to the edge of the point of rupture of the membranes. In this case the external bleeding had been less than that which had been retained between the chorion and the uterine wall. The serous discharge which so frequently follows the frank bleeding in a case of threatened miscarriage is probably the expression of blood serum from the retained blood clot or from the inflamed area of beginning infarct.

Most of the above cases were collected during a period of 6 months and similar cases must be occurring in every obstetrician's practice. All that is required for their identification is careful history taking, note taking, and close observation of the placenta.

These cases not only demonstrate the significant relationship between the clinical events of the pregnancy and the findings in the placenta, but they also demonstrate the diversity of manifestations which are attendant upon infarct formation when it is appreciated that the infarct is infectious in origin.

The case which shows frank infection in the throat followed by uterine bleeding and this uterine bleeding is coincident with the formation of an infarct demonstrates a very clear sequence of events. It is apparent also that an infarct may form in the placenta without any outward manifestation, since the outward manifestation requires that the bleeding or serous discharge must be sufficient in quantity to dissect its way downward from the edge of the placenta between the chorion and the uterine wall to the cervix and vagina. Likewise chronic sepsis may cause infarcts without manifestations either in the mouth or vagina.

In these days when so much weight is given to laboratory and bacteriological evidence, it will be asked, Why not endeavor to find bacteria in these infarcts, and why have they not been found before?

A careful consideration of this feature of the problem will not only explain the last question but also will show that it is almost impossible of attainment.

In the first place it must be remembered that the acute infarct, that is, the one with active bacteria contained therein, is a red inflammatory affair. It can not be identified by the naked eye on the surface of the placenta. The white infarct which we see ordinarily is the end-result of this process which originated weeks and months previously. The white infarct does not represent present infection but past infection. It is similar to a healed scar. In order to identify the area of acute infection the placenta must be sectioned, stained and studied with the microscope. It seems to me that this explanation not only makes it clear why the etiological factor has not been discovered but also makes clear that this form of research is almost sure to be fruitless.

Placentas *in situ* are the only ones which offer a reasonably fertile field of examination.

It must be borne in mind that the bacteria arrive via the maternal blood vessels. It is probable that the evidence of infectious inflammation may be located principally in the uterine wall, even after the birth of the placenta. This feature may account for many of the foul lochias after careful asepsis at the time of delivery. Reference to the pathological report in the case of Cornell and Earle referred to in my other paper (2) and the second case described by Thompson in his article (4) on "Placenta Prævia" demonstrate by their findings that the infarct is the result of infection.

The history of the following case strongly suggests that an acute infarct may be torn open at the time of birth resulting in infection of both mother and baby.

Case 15. A multipara was seen in consultation at the end of the second day after delivery. The mother had a temperature of 102 but did not seem severely ill. Nothing could be found in the case to account for her fever other than uterine sepsis. The baby was moribund with very high temperature and respirations and a bright petechial rash over its whole body. The baby died next day.

Up to the time of delivery the mother had felt well. The onset of the fever in both mother and baby had come within the first 24 hours.

To explain such a case it is necessary that the source of infection which made its appearance in both mother and baby simultaneously must have been present before delivery. As there was no evidence of it previous to delivery, it is probable that the labor was the means of bringing it to light.

If we picture an acute infarct in the placenta, it is easy to see why both mother and baby became infected simultaneously. The baby received virulent bacteria into its blood stream during the contractions of the uterus in labor from the acutely inflamed area in the maternal vessels of the placental site. The detachment of the placenta following the birth resulted in the increased activity of the bacteria still in the uterine wall. The mother recovered because she had previously acquired an immunity to these bacteria which in all probability came from a tonsil which had been abscessed several times (quinsy) previous to her pregnancy. The baby had no such immunity and died.

The clinical events described in the above 15 cases demonstrates a clinical entity. The evidence is convincing when it is found that the shape of the placenta and the position of infarcts thereon can be prophesied with reasonable accuracy.

Case 11, as well as other cases in my practice, demonstrate the corollary to be true. This case had no untoward symptoms during her pregnancy until her attack of influenza. The cord was attached to the center of the placenta which shows that it had enlarged concentrically until the acute infection came.

Not only do these cases demonstrate the etiological factor in infarct formation but also they show that infarct formation is due to many different kinds of bacteria. The clinical sequence of events shows where treatment can best be directed in the prevention of the consequences which follow upon infection of the placental site.

In a subsequent paper I shall show evidence of the consequences of infection of the placenta, the relation of infarcts to toxæmia of pregnancy and the effects of chronic sepsis in the pregnant woman.

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ILEOSTOMY FOLLOWING RESECTION OF THE COLON

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THAT deliberate ileostomy following resection of the large bowel is a rational and advantageous procedure seems to be logical, and in a series of such operations performed in the Mayo Clinic its practicability has been so marked as to warrant its adoption as a routine measure.

Resection of the right half of the colon is a technical procedure, safer, easier, and better from the standpoint of prognosis than the resection of the left half because (1) the mobility of the right half of the colon generally is such as to make it approachable without too much difficulty, and even in cases in which the mesentery is short the division of its outer leaf from the parietal peritoneum makes it possible to rotate the viscus toward the middle line and to reach its lymphatics and blood supply with comparative ease, and (2) the blood supply is more constant than in the left half, and, consequently, a resection up to a point of election can be made more readily without the fear of necrosis at the point of anastomosis. The blood supply of the ileum is of no moment and the continuity of the intestinal tract may be restored either by end-to-end or lateral anastomosis as the preference of the operator dictates. The former, has proved most acceptable to us. It is made with three layers of sutures, two of chromic catgut and one of silk. Should the lumen of the two ends of bowel be disproportionate the ileum is split opposite the border of the mesentery, as suggested by C. H. Mayo, and the anastomosis completed in layers. The mucosa is closed with chromic catgut, as in a Moynihan type of gastro-enterostomy, and the serous layers with one row of catgut and one of silk sutures. If the lumen is kept open by holding it between the thumb and index finger using these as a sort of removable obturator during the anastomosis, the danger of leaving too small an opening is avoided.

Because of the uncertainty of the blood supply of the left half of the colon as well as the technical obstacles encountered in attacking the splenic flexure and lower sigmoid, its removal is a formidable undertaking. Whether end-to-end, lateral anastomosis, or the Balfour method of using a rubber tube is resorted to in order to restore the continuity of its lumen, one hesitates to conclude without abdominal drainage because of the ever-present danger of leakage at the suture line. Fortunately, the few resulting fistulæ are usually of short duration and the local peritonitis which sometimes follows, rarely spreads.

Deliberate ileostomy in all resections of the colon reduces, to the minimum, distention from flatulence with resulting tension on the suture line and makes convalescence as uneventful as possible.

The advantages of an ileostomy as a "safety valve" and a ready drain to the proximal intestine are obvious. The idea of a safety valve against back-pressure from gas first was suggested by bringing out the appendix through a stab wound in the flank and later cutting it off to allow the escape of flatus; this is still practiced by many surgeons. The poisonous products of chronic, progressive, intestinal stasis, due to neoplastic obstruction, are such that the combined operation, that is, first, relieving the obstruction and then removing the offending growth, has forced itself into popularity. Whether one employs colostomy for a rectal or sigmoidal growth, or cæcostomy, as advocated by Stiles, drainage is established, and the second stage of the operation is rendered infinitely safer. We have not as yet put enterostomy to such use, but it seems to offer much the same advantage as following resection.

TECHNIQUE

We have found an adaptation of the Witzel method of gastrostomy simple and advantageous. It has seemed preferable to attach the loop of intestine with its tube into the lower angle of the incision which is usually

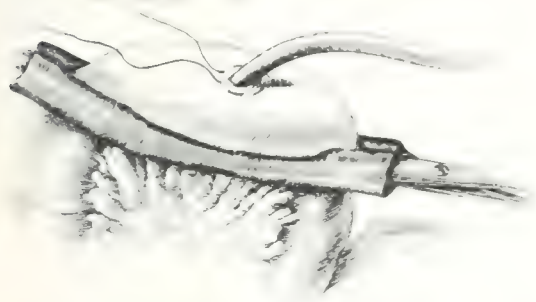

Fig. 1. Purse-string suture placed around the tube after its introduction into the bowel.

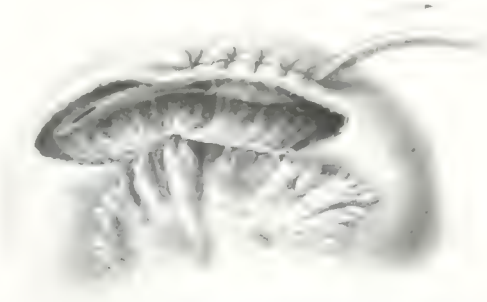

Fig. 2. Purse-string suture tied at the opening in the

paramedial, rather than to make a new stab wound in one or the other of the iliac fossæ. Prolonged wound drainage from contamination is rare, and intestinal fistulæ have not been observed. A loop about 30 to 40 centimeters proximal to the line of anastomosis is caught up and held lightly in rubber-covered clamps after being stripped of its contents as dry as possible. In its center opposite the mesenteric border, a purse-string suture of silk is placed and through this an opening is made into the lumen of the bowel either with knife or cautery, as suggested by Long. A rubber catheter, with the end cut off and several fenestrations in the side, is inserted into the lumen, the purse string is tied and cut, and a new suture used around the base of the tube, making a second invagination. The tube is now laid along the long axis of the bowel and depressed into its wall, while the serous and muscular coats are drawn over it with the second silk suture, which has already been used around its base. The depression of the tube into the bowel wall for 2.5 to 5 centimeters insures against leakage and future fistula. It is well to fasten the tube into the bowel more securely by passing the last suture through the lumen of both. C. H. Mayo has sometimes employed the Coffey method of incising the bowel down to its mucosa and closing the outer coats over the tube (Figs. 1 and 2).

After completion of the enterostomy, the catheter is attached in the lower angle of the wound to the parietal peritoneum and the catheter is closed off with a clip, to be opened when occasion demands. We have found it a decided advantage to use a very small catheter since the fluid content of the bowel can be drained slowly if necessary; evacuation of gas is the primary object. We have used No. 8 and No. 12 catheters and have decided in favor of the smaller. The silk sutures through the tube generally pull through readily and the catheter drops out of its own accord, usually about the twelfth day. In one case a larger tube stayed in 17 days. The tube may be opened at any time and drained into a bottle fastened in the dressing. The ease with which distention is thus prevented is in striking contrast to the persistent and less successful use of enemata [1, 2].

The surgical procedure should be supplemented by rigid adherence to the principle of giving nothing by mouth for several days after the operation. Fluids by hypodermoclysis amply supply the tissues with nourishment and are easily tolerated if given in moderate amounts. Morphine in adequate doses to combat pain and inhibit peristalsis is essential. The too ready acquiescence in hospitals to the patient's demands for food within the first week of convalescence is to be distinctly deprecated.

Discussion

Nélaton, in 1858, successfully performed a deliberate ileostomy. However, years before, French surgeons had suggested some such practice in acute intestinal obstruction. Summers in 1920, in reviewing the history of en-

Fig. 3. Omentum brought down to cover the suture line. The needle passes through intestinal wall and peritoneum.

terostomy, credited to Renault its first employment in a case of strangulated hernia. Since then, various applications of the same principle have been devised and put into use as the indications were presented. Perhaps the most varied methods of technique have been evolved in attempting some form of jejunostomy for feeding in cases of malignant obstruction of the œsophagus or of growths in the stomach. The selection of the jejunum for enterostomy in cases of intestinal obstruction was first advocated by Victor Bonney, and later by Handley in contradistinction to the old and, up to that time, accepted theory that the first distended loop of intestine that presented itself should be opened and used.

While this procedure necessitates more manipulation and exposure than the simpler one of taking the first coil available, it drains the contents of Bonney's "segment of toxicity" more surely and successfully. The experimental work of a number investigators along the line of intestinal obstruction seems to bear out the contention that most of the fluid content of the intestinal tract is high in the small intestine.

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TOTAL TRANSPOSITION OF VISCERA

BY HENRY H. SHERK, M.D., F.A.C.S., Pa[illegible] C[illegible]

As an anatomical curiosity *situs viscerum transposus* has always been of considerable interest to the anatomist and embryologist and instances of this abnormality have been observed and recorded since the time of Aristotle. To the clinician its recognition has more practical significance and is of extreme inportance from the standpoint of differential diagnosis.

Until (1) recent years most of the recorded cases had been found on the dissecting or post-mortem table. Now, however, the reverse is true and the majority are recognized during life by the clinician. The X ray and the present day thorough and systematic routine examination are responsible for this.

Aristotle's writings (2) show that he had observed two instances of transposed organs in animals.

Petrius Servius (3), in 1615, recorded the first recognized human case as occurring in Rome, but Carl Beck (4) states that the earliest authentic case was reported in the time of Moliere, in the person of Marie de Medici, Queen of France.

Kuchenmeister (2), was the first to recognize the condition during life, based on examination by percussion and auscultation.

According to Sorge (1) the first X-ray record of this condition was made by Vehemeyer in 1897.

In 1865 Grueber (5) collected 79 cases from the literature, only 5 of which had been recognized during life.

Kuchenmeister (5), in 1888, collected 130 cases. By 1895 Pic (5) was able to collect 190 reported cases and in 1902 Arneil added, including his own, 44 more, 38 of which were recognized during life.

Karashima (2) in 1912 catalogued over 200 cases and gave what is probably the best historical résumé.

From the literature at my command I have been able to find 24 cases reported since 1912 and have received verbal reports of three unpublished cases (J. M. King, S. J. Mattison and H. A. Royster).

These figures cannot be accepted as accurate or complete for this anomaly has been reported under so many different titles and individual cases so often duplicated, in the published articles, that it is very difficult to sift them out.

A communication from the Mayo Clinic states a hurried search of their records shows 10 cases indexed since 1910. For the same period their registration was approximately 347,000.

Only two writers (6 and 7) have mentioned observing this condition in recruits during the late war. It would be interesting to have the figures of the findings, in this regard, of our draft and army examining boards.

By transposition of a viscus (*situs viscerum inversus* or *transversus*) is meant, not only that the organ is situated on the side of the body opposite to its normal location, but that it is also reversed as to its actual structural relationship, presenting, in comparison to the normal, as if seen in a mirror. For example, in transposition of the stomach the pylorus lies to the left and the cardia to the right, or, in transposition of the heart the relative position of the auricles, ventricles, and vessels is reversed.

When the viscus is not reversed in its abnormal location it is simply a displaced organ or in a condition of *situs perversus*.

Of course an acquired dextra cardia is never a true transposition of the organ.

Transposition of the vicera may be total or partial. The former is by far the more common. The latter is very infrequent. This is especially so of true congenital dextra cardia, as an isolated condition, of which Schrotter (8) says, "none, not combined with transposition of other viscera, have actually been confirmed by autopsy." Contrary to Schrotter's statement, Kriezer (8) in 1880 collected 14 reported instances of isolated congenital dextra cardia. Of these 14, how-

over, only 5 were proven by post-mortem examination.

Total transposition of viscera is apparently twice as common in men as it is in women (5) and, when occurring in women, it has no effect on their childbearing ability (9).

Statistics on which to base the incidence of heredity could not be found in the lietrature, no cases having been recorded in which the condition occurred in parent and child. Brimblecombe (10) reports one instance of two cases in the same family, brother and sister.

Many theories, as to the determining factor in the causation of this condition, have been advanced—but none has been substantiated (5, 11 and 12).

The most plausible explanation (3) is the one that ascribes it to the changed position of the primary cardiac tube in early embryonal life, a reversal of its direction from a normal "S" to the reversed "Ƨ." This change (8) of position is probably caused by the reversal of the direction of the blood current which occurs if the usual relationship of the embryo to the primitive chorion is altered, so that its right, instead of its left, side is placed nearest its blood supply.

Von Baer (5) ascribes it to the changed relations of the embryo and the umbilical vesicle. Normally it lies on the left side of the vesicle, but if it lies on the right side transposition of the viscera occurs.

Rindfleisch (5) believes that a reversal of the spiral turning of the blood column is the causative factor.

Virchow (5) emphasizes the influence of the umbilical cord. In *situs transposus* it is wound spirally to the right, like a right-handed screw, the reverse of the normal which is to the left. This fact, if true, is of real practical importance.

Adami (12) quotes the monochorial twin theory, but puts little faith in it.

In his article (5), Arneil takes up most fully, the many theories that have been put forward by various writers.

A reversal of all of the ordinary physical signs occurs in total transposition of the viscera. The position of the apex beat, the cardiac dullness, and valvular sounds, the liver dullness, and the stomach tympany are all transposed and reversed. Also, in the male, the right testicle, in the majority of instances, hangs lower in the scrotum than does the left.

The reversed spiral twist in the umbilical cord may be present when the newborn infant is the subject of transposed viscera (5).

The X-ray findings simply show a picture as if the photographic plate, taken of a normal individual, were reversed.

Theoretically the speech center in the brain should be transposed (12 and 13). This is of special interest to the neurologist and the neuro-surgeon, in so far as it influences differential diagnosis. Correspondingly the subject should be left-handed, but this is an inconstant finding.

Electrocardiagraphic tracings sometimes show inverted waves (14 and 3)—but this also is not constant.

The transposed organs develop normally (3), and their abnormal position apparently has no effect upon their functioning or upon the general well-being of the subject of total transposition. They are normally able to undergo exertion without distress or undue fatigue and are not more than ordinarily susceptible to disease (15).

On the other hand the subject of partial transposition is generally deficient in stamina and suffers distress upon slight exertion (15).

Recognition of the abnormality is generally easy, except when associated with some pathological condition which might account for an acquired malposition of an organ.

It is surprising how many of the reported cases of transposition of the viscera remained unrecognized until the abnormality was disclosed at operation or autopsy.

Virchow (4) found transposed viscera, *post mortem*, in a case where, in spite of the observation of reversed ordinary physical signs, the clinician had stated that on auscultation the heart sounds were "heard with difficulty on account of the presence of bronchitis" and that the "spleen was very much enlarged."

One reported case had been examined five times for life insurance without the condition of transposed viscera being recognized (5).

Fig. 1. Roentgenogram of chest in another case.

Lane (6) reports a case of a soldier who had previously been examined several times and his abnormal condition passed unrecognized.

From a diagnostic standpoint the knowledge of the existence of a condition of *situs viscerum transposus* is of extreme importance in the presence of most of the inflammatory diseases and injuries of the chest and abdomen. In some its recognition is essential to a correct differentiation.

It is unnecessary to enumerate the many pathological conditions in which this has a bearing.

It is also unnecessary to emphasize the great importance of making a complete and thorough physical examination, with the possibility of this anomaly in mind, as a routine procedure in every case.

In newborn infants an umbilical cord with reversed twist should always suggest to the obstetrician the possibility of an associated visceral transposition. How seldom this is observed and how few babies are given more than a casual glance, to see if there is any gross external malformation, is only too well known.

Every individual, in whom transposed viscera are observed, should be fully advised as to the abnormality and be instructed, in case of illness or accident, so to inform the attending physician. This precaution may prevent an unnecessary operation or at least obviate inconvenient or duplicated incisions.

My own case, seen recently, is as follows:

Miss M. A., Norwegian servant girl, age [illegible], height 5 feet 6½ inches, weight 166 pounds net, consulted me October 11 [illegible] of gradually increasing amenorrhœa. Family history negative. Mother died of kidney disease. The patient was a large, hearty girl with bright complexion, who said she had had no illness since childhood, except an attack of influenza about 2 years ago. Her menses began at [illegible] last. Scanty type [illegible]. Suffering little pain, which, when present, always occurred at the start. The patient's [illegible] nervous type. Does not overwork. Has no past sexual history, at least none could be elicited. Said her menses for past year had become less and less. Her last period had ceased 2 days previously. It had lasted less than [illegible] been more than [illegible]. [illegible] nancy, to allow inspection of the breasts without

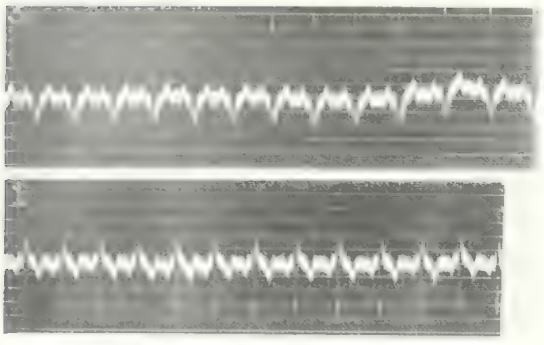

Fig. 3. Graph showing normal curve at top, 3, reversed curve, 1, author's case, 7, at bottom.

drawing attention to them. The breasts were well developed but negative. Auscultation of the usual heart area elicited rather faint heart sounds, though not more faint than often heard over normally located hearts. No apex impulse could be felt. On listening over the right chest the heart sounds were heard, loud and distinct, in the reversed position. The apex beat could be felt, in the right nipple line, exactly opposite to the normal position on the left. Percussion of the upper abdomen and lower chest showed tympany on the right and dullness on the left, the latter corresponding in size and outline to the ordinary liver dulness. There was no abdominal tenderness. The spleen and kidneys were not palpable. The external genitals were well developed and symmetrical. The introitus admitted two fingers freely. The cervix was small, hard, and conical and pointed downward and forward. The fundus was not definitely palpable, owing to the firm rigid abdominal muscles, but it certainly was not enlarged and was apparently retroverted. Nothing was discovered to suggest pregnancy. A second examination, made one month later, demonstrated an undersized, sharply anteflexed uterus with the body small in proportion to the cervix. The adnexa were not palpable.

The chest findings were corroborated by my colleague, Dr. J. D. Condit, who also made roentgenograms of the chest and abdomen. His report of the X-ray findings are as follows:

October 17, 1921. No. 3890. *Chest film* shows the heart with the apex on the right side, 3½ inches from the median line at a distance of 36 inches. The heart shadow is perfectly normal in size and shape, but reversed. The curve of the aorta comes at the normal relation, but to the right of the spine. The diaphragm shadow on the right side is lower than on the left side and shows the gas bubble in the upper pole of the stomach on the right. The relative height of the two sides of the diaphragm are normal. The chest is otherwise negative, except for a moderately normal anount of hilus thickening.

October 18, 1921. No. 3894. *Abdominal film*, barium meal and enema given simultaneously. The enema entered a normally placed rectum, passed through a small sigmoid, up the right side of the abdomen. The splenic flexure is placed on the right. The transverse colon passes across level with the second lumbar vertebra to a hepatic flexure normally related, but on the left side. The appendix did not fill. The ileocæcal valve is competent. The stomach is seen horizontally placed in the uppermost part of the abdomen, normal in size but transposed.

The entire contents of the chest and abdomen appear in the films as absolutely normal in size, shape, and relationship except for their transposition.

Electrocardiograms were taken by Dr. A. S. Granger whose report is here given:

There is a complete reversion of all the waves in lead 1 which is typical of a complete transposition of the heart, and only seen in that condition. Leads 2 and 3 replace each other, but no reversion of waves is seen. The mechanism of this is as follows:

Lead 1 is a symmetric one from the right arm to the left arm. A lead taken from the left arm to the right arm in a normal subject produces an inverted picture, consequently the left arm stands to the normal subject as does the right to the subject of transposition.

A lead from the right arm to the left leg (lead 2) in a normal subject is almost equivalent to a lead from the left arm to the left leg in the subject of transposition (lead 3). So in the letter, leads 2 and 3 replace each other, but neither shows reversion of the waves.

Besides the above characteristics, the cardiograms are entirely normal, and very typically show the condition of dextra-cardia present.

It is interesting to note that this patient had never been conscious, as some of these subjects are, of the heart sensations on the right side and, although examined physically several times when she had the influenza and once or twice at previous dates, the transposed position of her organs had never been recognized. She is right handed and there is no asymmetry of figure, spine, face, eyes, nose, throat, or neck.

SUMMARY

1. Total transposition of viscera is not so very infrequent.
2. Its standing has changed from that of an anatomical curiosity to a matter of clinical interest and importance.
3. It has no effect on the health of the individual.
4. Its recognition is extremely important in certain surgical emergencies.

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THE GERMICIDAL CHARACTER OF THE EMANATIONS FROM COLLOIDS OF CERTAIN SILVER SALTS

A Preliminary Report

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FOR some time our interest has been directed to improvements in the preparation of germicides suitable for application to mucous membranes. This interest was further stimulated by the studies of Colonel Hugh H. Young after his interesting report on mercurochrome 220. Knowing that metallic silver had the quality of preventing the growth of micro-organisms immediately around it, we hoped to secure a preparation which would exhibit this quality and at the same time be non-irritating and if possible non-staining. It would not be of value to record our failures, as our early efforts were without encouraging results.

When we began, however, with the colloidal preparations of silver, the results became more satisfactory, notably with the colloidal silver chloride. This proved to have a high germicidal value, was non-irritating and did not stain unless it was exposed to light before being washed. A series of laboratory tests encouraged us with the prospects of obtaining a better preparation than those now employed. We now make a preliminary report of our clinical observations and laboratory tests, with photographs of some of them. A detailed account of both clinical and laboratory experiments will be made later as our findings seem to open a new field for study and work.

The photographs of agar plates showing the various tests with silver wire, colloidal silver chloride, colloidal silver iodide, and other silver salts, on cultures of staphylococcus aureus show a fact which we think has not hitherto been observed; namely, *that colloidal silver preparations give off emanations which prevent the growth of micro-organisms immediately around the sealed glass tubes containing them.*

This fact became of still greater interest when we found that the colloidal silver chloride was non-irritating to mucous membranes even when employed in a strength sufficiently strong to be of greater germicidal value than carbolic acid.

The comparative harmlessness of this preparation was clearly shown by the fact

Fig. 3.

Fig. 4

Fig. 1. Silver wire showing emanations destroying staphylococci around the wires. It was this phenomenon which led us to make the study of colloidal silver salts.

Fig. 2. *1* and *3*, silver iodide; definite emanations. *2*. Colloidal silver chloride, small in amount as shown at dark part. Small amount smeared inside tube. This shows emanations extending more widely from the part where there is a space in the tube

Fig. 3. *1*. Colloidal silver iodide, emanations evident. *2*. Nitrate of silver, emanations negative. *3*. Colloidal silver chloride, emanations positive.

Fig. 4. *1*. Weak preparation; glass tube wrapped with 2 layers peritoneum; negative except emanation halo at burned end. *2*. Strong preparation, glass tube wrapped with two layers of peritoneum at one place, with 2 layers of cellosilk at the other. Definite penetration observed.

that spermatozoa could live and remain actively motile in it for 10 minutes or longer. The highly organized and delicate character of these cells would naturally show quickly the result of irritating or poisonous chemicals. When we found, therefore, that the laboratory reports of Dr. John Funke, professor of bacteriology at Emory University, showed

Fig.

emanations, with wider sterile space at end of middle tube.

Fig. 6. *1.* Colloidal silver chloride in blue tube, thick glass, negative. *2.* Same preparation in thin clear glass, burned in flame except at point near clear end where emanation effect is apparent. *3.* Same colloidal silver chloride in thick yellow glass, negative.

emanations positive; culture one week old and secondar-
olloidal silver
chloride in tube wrapped with four layers of perit
and covered with collodion; eman

that 5 per cent colloidal silver chloride, when diluted 400 times, killed the typhoid bacillus in 2½ minutes and yet spermatozoa could live in the 1 per cent solution for 20 minutes or more, we felt that this preparation was remarkable. It clearly showed a selective action against micro-organisms and was not irritating to the body cells to which it was

applied. A 5 per cent solution of silver chloride diluted 4,000 times, mixed with an equal quantity of secretion from a foul mouth in which actively motile spirochætæ were observed, stopped the motility of the spirochætæ in 4 minutes. Many subsequent tests confirmed the early encouragement and now we have employed it in 300 patients with genito-urinary affections.

We were pleased to note in the July, 1921, number of the *American Journal of Urology*, an article by Dr. Ralph B. Cobb entitled "A New Advance in Silver Therapy," who reports very satisfactory results with colloidal silver chloride as prepared by Hille, the discoverer of argyrol. His observations of its clinical application to the mucous membranes of the urologic organs are in accord with our own work.

We sealed our colloidal silver chloride in the anterior urethra, using collodion over the meatus to prevent its escape, and it was without pain to the patient when so employed for 3 to 5 hours, nor was urination painful after the collodion was removed. The mildest remedy we have been able to use in this manner, heretofore, was argyrol, and yet it was not without discomfort and did not have anything like the germicidal value of the colloidal silver chloride, which Dr. Funke's report shows is several times stronger than carbolic acid. Neosilvol was non-irritating but lacked either germicidal qualities or penetration.

EMANATIONS

Colloidal silver chloride has the faculty of giving off emanations which apparently penetrate further into the tissues than any of the remedies we have been able, heretofore, to obtain. This fact is shown by both laboratory and clinical tests, for the clinical tests lead us to believe that we are able to destroy gonococci in the glands of Litre in the roof of the urethra when the solution itself could not enter them. The mucous membrane seems to be no more difficult for the emanations to penetrate than is glass, which the photographs of the agar plates show offers little obstruction

We are unable to explain why some of the tests with colloidal silver choride show negative results as regards emanations, while others, quite similar, are positive. Our first thought was that there was a leak in the tubes and that this accounted for the emanation phenomena, but a careful study of the tubes and plates did not account for this. The thickness of the glass tubes accounted for some of the failures. Dilutions of the colloidal silver chloride accounted for others, while there still remains a series of negative results unaccounted for, except perhaps for the fact that traces of lead were in some of the capillary tubes or some of the sodium in the glass interfered with the emanations. We are duplicating our results with nonsol or Jena glass tubing to obviate the discrepancy. Tests were made with cellosilk, collodion and peritoneum from the intestines of pigs; all of these allowed emanations to pass through them (see photographs).

The reason that the colloidal preparation of silver gives off so much more of the emanation than the metallic silver is probably because of the enormous increase in the surface provided by the infinitely small subdivisions of the silver and the Brownian activity. It is not apparent why a 10 per cent solution of nitrate of silver should give off none or so little as not to influence the growth of bacteria on the agar plate; nor is it obvious why the colloidal chloride should give off more than the iodide. Equally puzzling was the fact that in the heated end of the tube, where some of the colloid is burned, there is frequently given off definitely larger amounts than from the part where only solution was in the tube, until we learned that Rutherford, in 1906, found that cocoanut charcoal absorbs radio-active emanations. Bancroft in his book on *Applied Colloid Chemistry*, 1921, in discussing this subject states that a slow current of air, at ordinary temperature, charged with emanations of radium, thorium, or actinium, is deprived of some or all of its emanations in passing through a tube filled with cocoanut charcoal. He further states in another experiment that Rutherford found that if a tube containing less than a gram of charcoal is connected to a vessel containing emanations from several milligrams of radium bromide, the charcoal will absorb the emanations in time. Further-

more, if powdered willemite be mixed with charcoal, the gradual absorption is shown by the increasing brilliancy or phosphorescence of the willemite. These facts explain why many of the burned ends of the glass tubes give off more emanations than the colloidal solution. The charred material in the burned ends evidently absorbs the silver emanations and then allows its escape with greater readiness than does the solution.

Empty spaces or bubbles also often destroy the germs for a greater distance than does the colloid. This phenomena is probably due to the wider play of the gaseous atoms. The Brownian movement so clearly seen with the ultramicroscope is only a visible demonstration of what is going on with infinitely smaller gaseous particles which are less obstructed by air than are the particles by the surrounding stabilizing solution.

Ehrenhaft[1] found that there is a much livelier motion in gases than in liquids, and his experiments led him to conclude that there is a motion in gases completely analogous to the Brownian movement.

The study of colloids, while most fascinating and intimately connected with much that goes on in and around us, is far too complicated and extensive to discuss in this connection. Many useful books have been written on colloids, their preparation and characteristics, and yet there remains much to learn about them. It is sufficient here to say that colloidal solutions of metallic sub stances or insoluble salts consist of minutely subdivided masses held in suspension by their Brownian motion.

CLINICAL USES

No irritating effect was noted when this preparation was given as an injection or instillation into the urethra, injected into the bladder, injected into the pelvis of the kidney for pyelitis; injected into fistulous tracts, abscess cavities or broken down buboes, applied to the conjunctiva, mucous membrane of the nose, throat or inner ear, antrum of Highmore, used as a wet dressing, etc.

Intravenous injections. Rabbits inoculated with fatal dose of staphylococcus aureus did [illegible] colloidal silver chloride solution was given intravenously 15 to 20 hours later. The control rabbits which received similar injections and not treated with colloidal silver chloride promptly died with multiple [illegible] scesses of the kidneys, heart, and other organs.

The rabbits were sometimes not disturbed by 2 cubic centimeters of the same solution given intravenously. Freshly made solutions were found to have greater germicidal value than the preparations several days or a week old.

Intra[illegible] [illegible] timeters diluted with an equal quantity of physiologic salt solution was given intra[illegible] toneally and the rabbits lived, though they appeared sick on the day following the injection.

A series of experiments are now being made with tubercular and other infections than the staphylococcus aureus, and in due time we will report the results. The work is being done by Dr. Klugh in the laboratory of Drs. Bunce and Landham (who also made the agar plate tests) and by Dr. John Funke.

Silver chloride has the formula Ag. Cl. and is found free in its natural state as a substance known as horn silver; it can be prepared by mixing a solution of sodium chloride with a solution of silver nitrate and appears as a curdy, white precipitate, which darkens when exposed to light. It is decomposed by caustic alkalies to an oxide. It is soluble in ammonia water, thiosulphates and cyanides, and is insoluble in water and dilute acids. It melts at 500° F. and forms a translucent mass (horn silver). Finely subdivided in its colloidal form, its minute masses are [illegible] tively charged, moving to the positive pole (anionic). In a colloidal form it resembles diluted milk or whipped cream, according to the stabilizing solutions. The size of the infinitely small masses in the colloids vary according to its preparation, from those so small that they cannot be seen to the larger ones which are readily visible with a dark field microscope as actively motile masses about the size of micro-organisms such as the staphylococcus or larger. Colloidal silver chloride is

miscible with fæces, urine, blood, gastric juices, and pus, and retains its colloidal characteristics for a few days to a week or longer according to conditions.

THEORY OF GERMICIDAL ACTION

The active bacteriotropic character of colloidal silver chloride leads us to wonder whether its activity is due to a chemical process or to the germicidal emanations. It seems difficult to conceive of its radiated atoms having sufficient size to combine in a chemical way with the micro-organisms in sufficient quantity to kill germs. Perhaps the emanation destroys the germ as does sunlight or emanations of radium. Subsequent studies may enable us to find how the germicidal action of the emanation affects its results. Colloidal disinfectants are adsorbed by the micro-organisms and thereby become concentrated on the surface of the organism and also penetrate the membrane which surrounds them.

Heidlberg, under a high power microscope, has observed colloidal solutions enter the gelatinous membrane covering the bacteria, after which the membrane swells and bursts. This observation, and also the fact that colloids possess high antigen power, as is evidenced by the fact that 1 gram of collodial iron will neutralize 50 diphtheria toxic units or 10 tetanus toxic units, may in a measure explain the germicidal action of the colloids.

COLLOIDAL BODIES IN THE BLOOD PROBABLY TAKEN UP BY THE LEUCOCYTES AND ENDOTHELIAL CELLS IN INFLAMED AREAS AFTER INTRAVENOUS INJECTIONS

The fact is well recognized in physiology that the leucocytes (phagocytes) "devouring cells" take up small foreign substances circulating in the blood stream. Our work so far leads us to believe that some of the colloidal bodies such as silver chloride are taken up by the phagocytes. These cells have also another mission, namely: to go to the points of inflammation, and thus they tend to concentrate the intravenous germicide where it is most needed. It would take us beyond the scope of our preliminary report to elaborate on this interesting phase of our experiments, concerning which we have some pertinent facts to discuss in detail later.

The surprising part of the work is that we have been able to carry on a series of successful experiments with a chemical so simple and one found in the pharmacopœia, the only thing necessary being to make it into a colloidal state.

An adequate supply of colloidal silver chloride is being sent to 200 of my medical friends to determine if their clinical results duplicate our own.

SUMMARY

1. Colloidal silver salts, notably the chloride, give off definite germicidal emanations. These emanations prevent the growth of micro-organisms on Petrie agar plates in the immediate area surrounding the sealed glass tubes containing the colloidal silver chloride.

2. A 1 per cent preparation has a germicidal value about equal to pure carbolic acid, yet when sealed in the anterior urethra for 5 hours is without pain, even with much stronger preparations. No irritation is produced when applied to mucous membranes such as bladder, nose, throat, sinuses, etc. Good results followed its application to abscess cavities, fistulous tracts, and also when used as a wet dressing for infected wounds, mastoid incisions, etc.

3. Spermatozoa will live in a 1 per cent preparation 20 minutes or longer. Being highly organized and delicate cells, this shows its relative harmlessness as a germicide.

4. Diluted 4,000 times, a 5 per cent preparation killed the spirochætæ from a foul mouth in four minutes.

5. Given intravenously to rabbits artificially infected with the staphylococcus aureus, 1 cubic centimeter of a 1 per cent preparation cured the rabbits, sterilizing their blood within 24 hours, while controls, untreated, died within 48 to 72 hours with multiple abscesses of the liver, kidney, heart, and other organs.

THE TEST OF LABOR[1]

RESULTS IN ONE HUNDRED CONSECUTIVE ELIMINATIVE AND [illegible] CASES

BY W. GEORGE ELY, M.D.

MANY new obstetrical procedures are being advocated today, some to be employed almost as routine measures, each one as a panacea for certain obstetrical difficulties. Prophylactic forceps, routine podalic version and extraction, or mechanical induction of labor at a definite date, determined by estimation of fœtal age, are some such already prominent, and prophylactic cæsarean section may not be long delayed. Such titles in themselves, at times, tend to dissolve criticism. Who of us but is interested in prophylaxis? All of these measures have such earnest and able sponsors that we are thereby committed to impartial weighing of their merits, even though some must finally be ruled out perforce as being mutually incompatible. We here are concerned only, however, in trying to determine the value of methods long used, to enable us to compare the value of such older practice with the newer methods.

Does not the story of "Aladdin and his wonderful lamp" offer an allegory for us? There the cry "new lamps for old" was effective and though doubtless many benefited who gave their old possessions, still the fact remains that Aladdin's lamp was exchanged for one incomparably inferior though new. The new always attracts, sometimes from mere desire of change, sometimes from the hope that it represents better things. But now, as in Aladdin's days, real worth may perhaps be recognized only with effort and analysis.

What are the best methods to use to improve obstetrical results? To answer this question we may paraphrase the familiar old saying: "the proof of the pudding is the eating" as follows, "the proof of the method is the result." Therefore we must compare those results that are variously obtained.

Labor is the active efforts of the pregnant uterus to rid itself of the viable products of conception by childbirth. The Art (or practical application of our knowledge) of obstetrics largely concerns labor. One definite method of procedure, that we call "the test of labor," utilizes the natural forces and mechanism in labor to their [illegible]

This paper is an analysis of results from this method in 100 consecutive cases. It is our belief that the test of labor is obtained only by allowing labor to proceed until childbirth either results spontaneously, or from operative assistance that reinforces the natural powers, so that birth is through the natural passages. Certain women should not be submitted to this test of labor. Definite pelvic obstructions, whether from marked contraction of the bony structure, massive scar tissue, or from the encroachment of tumors upon otherwise normal passages, usually present absolute indications for primary abdominal section. Also, when factors endangering life suddenly arise before, or very early in labor, that, for their successful treatment, necessitate prompt positive emptying of the uterus, the primary indication is for operative interference by a method appropriate to the emergency conditions, whether by abdominal section, vaginal cæsarean or *accouchement* [illegible] But such cases, not suitable to the test of labor, are relatively very few.

The test of labor should eliminate subsequent consideration of abdominal section as a method of delivery for the given pregnancy, for we believe that a few hours only of first-stage labor is futile in determining the answer as to whether successful delivery through the natural passages is possible. Miscalled tests of labor are tried at times in cases of relative disproportion, although such procrastination may increase the risks of abdominal section when done, while it does not eliminate the possibility of successful pelvic delivery, because not carried far enough. A true test of labor, even in border-line cases, will certainly be followed by the delivery of living and

uninjured babies in many instances, often operative but spontaneous in not a few. Even in the percentage where the fœtus of a particular labor does not survive, benefit to subsequent pregnancies may and generally does ensue, because fuller knowledge will indicate definitely that certain of these mothers are entitled to primary abdominal section, and that others will have successful natural labor subsequently, even though needing operative assistance in the present one. A completed test of labor, therefore, practically eliminates thereafter the border line type of case.

In the series of 100 consecutive patients, who had the test of labor, were 54 primipara and 46 multipara, 99 longitudinal presentations, 97 of which were vertex and 2 breech presenting parts, and 1 twin pregnancy, the first vertex, the second breech. Of 98 vertex cases, 69 were anterior positions, 2 transverse, and 27 were posterior. Fifty-one babies, including the uniovular twins, were male, 50 were female. Of these, 3 were born dead, and 1 died in 18 hours following operative delivery; 1 spontaneous delivery died in 3 days after birth from inhalation pneumonia.

The largest male baby of operative delivery weighed 9½ pounds, of spontaneous delivery 9¼ pounds.

The largest female baby of operative delivery weighed 8¾ pounds, of spontaneous delivery 8½ pounds.

The spontaneous deliveries varied from 21 hours, a primipara, to 1½ hours, a para-V.

The following table gives the percentage of occurrence in the primiparæ, multiparæ, and in combination:—

	54 Primiparæ	46 Multiparæ	100 Total
High interference	28	07	18
Mid-interference	09	02	06
Low interference { Forceps	35	19	28
Low interference { Extraction	00	03	02
Spontaneous	28	68	46
Total	100	100	100
Anterior position	60	84	70
About neck	22	30	25
Low-lying	06	00	03
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
Intrapartum hemorrhage	[illegible]	[illegible]	[illegible]
Beginning maternal exhaustion	26	07	17
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	1	1	51

Indications for operation were usually not urgent: 16 had inertia uteri, 1 was a first of twins, 4 were frail women, 1 of whom had acute diphtheria; 7 had exhaustion of the fœtus, 1 from cord about the neck, 2 from dry labor or oligohydramnios, 3 from combinations of these, and 1 from cause not ascertained. Spontaneous birth gave 5 babies needing resuscitation from 2 breech, 1 dry labor, 1 oligohydramnios, 1 low placental implantation cases.

There were 8 slight degrees of pelvic contraction, all in primiparæ, 2 flat in mid-forceps cases, 4 flat in low forceps cases, and 1 flat and 1 justominor in spontaneous birth. Of the 29 cases where the funis was involved, 1 had cord thrice about the neck, 4 twice, 1 had cord about neck and arm, 1 had a recent knot tightened during birth, in 3 the cord was low-lying and discovered only after operation was well started. The 5 premature labors include 1 (mid-forceps) in a primipara, and 1 with breech presentation in a multipara. Five very rapid labors occurred, all in multiparæ, 2 of these being apparently due to the only cases of polyhydramnios in the 100 cases. No serious cases of intrapartum hæmorrhage occurred. Eleven were third-stage in onset, and 5 second-stage; of the latter 4 were from low placental inplantation in multiparæ with spontaneous birth, 1 low placental implantation was found following a high operative delivery. Episiotomies were usually done, only after evidence that tearing was otherwise unavoidable. These combined with the number of second-degree tears represent about 50 per cent of the total number of patients. The cardiac conditions noted did not appear grave until labor had been in progress for a considerable time. No marked sepsis occurred except one abrupt onset of mastitis on the seventh day, following spontaneous delivery after short labor in a primipara with serious antecedent toxæmia. Both breasts were involved in all their quadrants and the infection apparently was due to abnormally low resistance, the invasion taking place through the milk ducts. Two cases with fever late in the puerperium were cured by quinine treatment, malaria-plasmodia being found. There was 1 manual re-

FACTORS IN HIGH AND MID OPERATIVES

Para.	Number hours to operate	Labor over edge	Position	Station	Dry	Edema	Rigid	Inert	Abnormal	Contracted	Deformed	Tumor	Dead	Living	Mother
I	24		P	High		X									
I	13		P	High	X			X	X						
I	24		P	High	X			X	X				Dead		H
I	16	X	P	High		X	B	X							
I	12	–	P	High		X	B	X				X			H
II	28		P	High		X	B	X							H
I	8		P	High		X	B	X					X		H
I	19		P	High								X			H
II	10		P	High	X			X							H
II	21	X	P	High			G	X	X						H
I	23	X	P	High				X					X		H
I	9		Trans. Vers.	High				X					X	Living	H
I	6		P	High			G	X							H
I	3		A	High		X		X				X			H
I	9		A	High	X			X							H
I	9		A	High	X			X							H
II	27		A	High			B	X							H
I	15		A	High			B	X							
I	21		A	Mid	X			X		X					M
I	18		A	Mid	X			X	X				X		M
I	1		A	Mid				X					X		M
II	6		P	Mid				X	X						M
I	17		P	Mid		X		X							M
I	11		P	Mid		X		X						Living	M

* H. F. = high forceps.

moval of the placenta done. The diphtheria patient had labor apparently started from administration of antitoxin, as there were no signs previous to it, while promptly thereafter vigorous uterine contractions began.

High forceps usually involve intra-uterine application of the blades and admittedly make very serious demands upon both doctor and patients. They are, therefore, condemned by some *in toto*. However, it seems to us that, where the delay is first-stage essentially, that is, due to cervix and lower uterine segments not being dilated, rather than second stage, that is, where there is bony obstruction or obstruction from tumor prolapse, there is a marked differentiation possible in the matter of procedure. We should bear in mind that in every dry labor or oligohydramnios that unaidedly completes the first-stage of labor, these uterine parts have been dilated by pressure of the fœtal head, hence high-forceps assistance in such like conditions may often bring the same results without damage to the mother or child, if such instruments are skillfully used without undue speed or excessive force.

Certain of the tabulated cases could probably profitably have had earlier induction of labor, so benefiting from a smaller baby. It is of interest that the two severest

FACTORS IN LOW CERVICAL AND CONTRACTED PELVIC II

therein with babies born dead have each since had spontaneous birth of normal babies as have also several others listed in these high operations on primiparæ.

Consider that these cases all were in labor for a considerable period before operative interference, and that the only early evidence of deviation from normal in most of them was lack of progress. That makes it plain that the recognition of lack of progress, and its underlying causes, is of very great importance, which is not always appreciated. Certainly obscure conditions, not to be diagnosed early, can hardly be available for preliminary vital decisions as to methods of delivery.

We believe that while other methods than high forceps might still have been used in most of these cases when finally the obscure conditions were recognized, maternal mortality would not thereby have been lessened and that indeed we might have had a marked increase in it, by any other method of delivery which did not, *pari passu*, increase markedly the fœtal mortality.

CONCLUSIONS

1. No patient should be submitted to the test of labor in whom are either obvious obstacles to pelvic delivery or emergency conditions necessitating speedy emptying of the uterus.

2. The test of labor, therefore, primarily concerns cases in which spontaneous birth is hoped for, in the present and subsequent pregnancies. Operative delivery, when spontaneous birth does not ensue, should be by the pelvic route.

3. Primiparity, posterior positions, dry labors, oligohydramnios, and constriction rings of the uterus, increase the percentage requiring operative delivery, particularly when they occur in combination. Constriction rings occur practically only where oligohydramnios or dry labor are present.

4. Lack of progress for a considerable time is the predominant indication for interference. Occurring alone the determination of the moment for such interference demands careful consideration and wise judgment.

5. Beginning maternal or fœtal exhaustion, or threatened rupture of the uterus, developing with lack of progress, present indications for immediate interference. Any lack of progress, however, demands prompt, careful analysis to determine its probable cause with particular watchfulness for the development of such subsequent urgent indications for interference.

6. Following a given test of labor, subsequent pregnancies should have an improved prognosis.

7. Forceps will always be the most used method of terminating non-spontaneous labors; therefore, the technique of forceps operation is of paramount importance, and should receive greatly increased attention in obstetrical teaching.

ROENTGENOGRAPHY IN OBSTETRICS

L. D. A. HORNER, M.D.

SINCE the beginning of my work in this field 2 years ago, several articles pertaining to the use of the X-ray in obstetrics have appeared in American literature. Heretofore, very little has been written, but it is safe to say that the near future will bring out much more, depending upon the readiness of the roentgenologist and the obstetrician to accede to the harmlessness of exposing the pregnant woman.

As an advance in obstetrics, roentgenography ranks with other comparatively recent discoveries, such as twilight sleep, pituitrin, rectal examinations in labor, the head stethescope and the low type of cæsarean section.

HISTORICAL

The surgeon and internist readily recognized the value of the X-ray in their own fields. Shortly after its acceptance by them, it became malpractice not to use it in various conditions. Today one wonders how they did without it for so long.

The obstetrician feared its action on the pregnant woman and the unborn babe. Only the bolder ones experimented with it half-heartedly. Superstition attributed to the apparatus all pathological conditions following its use. The timidity of the laity and the profession is even to this day quite pronounced.

The steps leading up to present-day use are few. In 1899 Mullerheim roentgenographed women with partial success. Before that, only fractional portions of the mature fœtus could be demonstrated. Thereafter, plates of the fœtus *in utero* were looked upon as roentgenographic curiosities. In 1913, Sjorgren of Sweden differentiated for the first time between intra-uterine and extra-uterine pregnancy. In 1912, O'Donnell stated that the position of the fœtus could be clearly determined from the fourth month. I shall consider this statement later. DeLee then in discussion fully outlined the limitations and possibilities of the X-ray. He emphasized its uselessness in determining the possibility of mechanical difficulties in labor except in gross deformities. In 1915, Judd showed a case of twins. In 1918, MacKenzie attempted measurements of the pelvis by this means and was partially successful. In the same year came the revolutionary work of Warnekros of Berlin on the fœtus *in utero*. Today, in all parts of the civilized world extensive roentgenographic investigations during pregnancy are being made.

PREGNANCY

By the ordinary means of roentgenography, I am convinced that it is impossible to show a fœtus *in utero* before there is sufficient ossification to form a skeleton. Both Hess and Adair arranged schedules for the appearance of the ossification centers in specimens taken from jars; but showing these centers in the fœtus *in utero* is another matter. Their density at 90 days is not great enough to show through abdominal and uterine walls as well as liquor amnii, until long after they can be demonstrated outside of the body. It is only after they are well developed and widespread that they can be attributed to fœtal bones and not to calculi, enteroliths or phleboliths, etc. At 120 days, or 4 months, only that part of the fœtus over the inlet is demonstrable, the rest being obscured in liquor amnii, muscle, and maternal bones.

O'Donnell, Albert Weil, and others claim positive diagnoses are possible at 4 months. Edling, as early as 1910, and Fornero, as late as last May, stated that at 3 months not only pregnancy but also presentation and *position* can be determined.

Unless these investigators have a refinement of technique beyond that of most present-day roentgenologists, their researches must be considered faulty. My own efforts satisfy me that the fœtus cannot definitely be diagnosed as such before quickening. After this it becomes a comparatively easy matter in women of average weight.

It was hoped that pneumoperitoneum would reveal something of value in the early months. It reveals nothing that the educated finger cannot tell us. Its place in obstetrics is associated with the recognition of accompanying tumors, adhesions, and ectopic pregnancy.

"Position" as stated by O'Donnell and Fornero must not be confused with "presentation." I have found in my study that the X-ray plate shows the size and clearness of the fœtus required to demonstrate "position." The collection of Warnekros is also called to your attention for a similar purpose. General practitioners sending patients to hospitals for deliveries often have no conception of the presentation and position in their cases. They depend for this information on the internes of the hospital even after having had their patients under observation for months. For such as these I would suggest at least one exposure before the onset of labor.

FŒTOMETRY

After demonstrating the fœtus, fœtometry is the next advance. The work of Hess is of value in establishing the age of the expelled fœtus. But there are occasions when the age of the fœtus *in utero* as well as its actual size is required. We attempt to measure its length and head diameters. The induction of premature labor and the prevention of over-term pregnancy can now be undertaken with a greater degree of certainty than heretofore. The dates of last menstruation, of conception, and of quickening, if available, are important in making decisions of pregnancy duration from plates.

It is not unusual for even the best obstetricians to be from 1 to 3 pounds off in their estimates of the size of the fœtus.

When abdominal palpation and mensuration are not satisfactory and dates are unreliable, roentgenographic interpretation can be depended on.

Six of my series were shown to be too large to navigate the passages successfully. Cæsarean sections were performed in these cases. Six mothers were thereby spared useless, difficult labors with extensive damage, and six babies who otherwise might not have survived are living today. In none of these cases was the fœtus over term. Pelvic measurements were close to normal.

At this point I may state that in not uncommon instances, cæsarean sections have been performed bringing forth deformed babies or monsters, thereby assuming an unnecessary risk for the mother. Several obstetricians insist on routine roentgenography before cæsarean section to view beforehand what the uterus contains; others are still fearful.

Objection has been raised to the use of the X-ray just prior to cæsarean section on the basis of its devitalizing power, comparing its effects on the peritoneum with that of radium. Fatal peritonitis has followed the administration of radium in uterine conditions. The shortness of the exposure to the X-ray as compared with radium, renders this procedure harmless. My experimentation on pregnant women shortly before cæsarean section has not been stopped by the faintest suspicion of peritoneal involvement. It follows that, given clean cases, peritonitis is still attributable to a slip in surgical technique and not to the X-ray. The endothelium of the knee joint is more sensitive than the peritoneum, yet the surgeon does not hesitate to employ it there.

PELVIMETRY

When DeLee (1912) stated that one could recognize *gross* deformities, distortions, and narrowing of the "inlet," practically nothing had been done to measure the pelvis with a view to ascertaining its *finer* defects. The recognition of gross deformities as related to childbirth is quite an accomplishment in itself, and is much to the credit of the X-ray. We often, in our crude external pelvimetry, take too much for granted when the measurements are normal. Difficulties encountered later, when the patient is advanced in labor are often unlooked for. Every obstetrician has encountered such cases. When discovered it is too late to do an abdominal operation. The expert obstetrician, it is true, would not be confronted with such problems as one not so skilled. The former realizes the value of the test of labor, the latter does not.

In many instances one can say that a certain head will successfully come through a given pelvis, but in a number (far greater than we admit), it is impossible to state positively. The importance of *knowing* definitely is more evident with each labor terminating with difficult high forceps and fœtal death. The conjugata vera and the bispinous measurements can be taken with the fingers or special instruments with a fair degree of accuracy. But we are not all proficient in ascertaining these cardinal internal measurements.

Many defects overlooked in external and internal examinations, e. g., marked contractions of the inlet, sacro-iliac disease, effects of old fractures, exostoses, callus formation following previous pubiotomy, etc., can be perceived at a glance.

The recognition of the finer faults can only be made by the X-ray if at all; and then only after much experience in interpreting the plates taken. The following-up of such cases clinically is essential to successful interpretation and is possible only in hospitals with large maternity departments; comparison in many cases being required. Collaboration of roentgenologist and obstetrician is of prime importance.

There are possibilities of error in interpreting the size of the inlet because of the varying degrees of tilting of the different pelves. If all pelvic inlets had the same angle of inclination to the horizontal, it would be an easy matter to estimate their measurements.

Higher mathematics have been employed in roentgenographic pelvimetry. The methods and calculations are too complicated for general use. But recently, I experimented with Chamberlain and Newell's stereoscopic method. The results obtained are excellent. Only a few simple geometric principles are involved in the solution of any or all the diameters.

Stereoscopic views at or just before term give a much clearer picture of the relation of the head to the maternal pelvis, and the probabilities of difficulty in engagement.

The measurements in cases of ankylosis of the sacro-iliac joint and the contracted types of pelves may be perfectly normal, yet

method of positively diagnosing the [illegible] laparotomy.

[illegible] roentgenographed as she was about to marry. [illegible] individual who realized the gravity of childbirth. [illegible] requests are not made. Even the ignorant, pregnant woman desires to know if "everything will be all right." Physical examinations for disease are required in several states before marriage, but seldom is the woman's fitness to deliver a normal child questioned. The grossest deformities of her pelvis are not considered a detriment, even though her first labor will be fatal to her and [illegible] specially prepared for all complications. A good share of the [illegible] deaths in this country resulting from labor could be spared if there existed a more general application of the X-ray for investigations of this sort.

With maternal conservation the watchword of the day, the above paragraph is more than speculative.

Infants are subject to trauma in the birth process. Without the X-ray many of these injuries are overlooked. With it, early diagnoses can be made and proper treatment immediately instituted. Fractures and dislocations [illegible] uncommon. Skull fractures are more difficult to [illegible].

We have also demonstrated dextrocardia, pyloric stenosis, enlarged thymus, effusions in the thorax, atelectasis, and tumors.

We have also demonstrated the extent of lateral displacement of the fetal head during the use of hydrostatic bags, thereby showing the ease with which a cord may prolapse following the expulsion of the [illegible]. We have [illegible] duction of a metreurynter.

There are many others uses to which the X ray can be applied. Pseudocyesis, obscure presentations, deflexion attitudes, and questionable multiplicities are easily settled. Associated surgical conditions in pregnancy and the puerperium are not uncommon. Calculi of the urinary and biliary tracts have been located and surgically treated without interruption of pregnancy.

The presence of foreign bodies in the generative organs is easily determined. This statement, when applied to obstetrics, may appear rather peculiar. But catheters, bougies, and pessaries used in various minor operative procedures, have been lost or forgotten. A Y-shaped, brass pessary was recently located in a freshly delivered placenta by one of my colleagues. The patient, when questioned concerning it, denied all knowledge of its existence. Unfortunately in this instance no roentgenograph was taken. Discovery might have created a knotty problem. A similar instrument was located in the fundus uteri of an amenorrhœic stout woman whose physician had inserted it as a cure for sterility. A roentgenograph revealed it although she had supposed it removed years ago. Its removal was followed by pregnancy, which might never have occurred without the roentgenograph.

In my review of the literature I have not come across the utilization of the X-ray in the diagnosis of intra-uterine death. However, during the past year in 3 cases where fœtal death was suspected, X-ray revealed overriding of the skull bones with asymmetry of the head. This to me indicated fœtal death and the subsequent clinical course bore out my belief. Therefore, overriding of the skull bones with cephalic asymmetry are signs of fœtal death and are the only positive signs of intra-uterine death.

EFFECT ON MOTHER

No appreciable effect on the mother has been noted in the past 2 years. I have been told that I have unknowingly produced sterility. Even temporary sterility is out of the question, as the exposures in most instances have been shorter than those required for gastro-intestinal roentgenography. Fraenkel's experiments on prolific lower animals showed that the ovaries will stand a great deal before losing their function.

Not a single instance of X ray burn has occurred.

EFFECT ON FŒTUS AND NEWBORN

Thousands of women are continually subjected to the X ray for other than obstetrical conditions before and during the early months of pregnancy, without effect on the ovum. I do not mean to imply that the X-ray cannot kill an ovum, but refer to the use of the apparatus in diagnosis. The modern abortionist uses it to kill.

Most of my cases were fearful of injury to the babe.

Werner recently mentioned three children of mothers exposed during pregnancy to X-rays 5 years previously. The children were normal in all characteristics except height and weight. How and why he attributes these deficiencies to the X-ray exposures of 5 years previous is not clearly seen. The same can be said of Aschenheim's imbecile, the child of a woman treated for uterine myomata; conception occurring between exposures. Stettner now adds two instances in which the eyes, ears, and genitals were deformed. Deficient growth, inferior mentality (as in Aschenheim's case) and disturbed co-ordination also existed.

Nuernberger's experiments on lower animals showed the spermatozoa, ova, and offspring normal, following exposures of minutes.

Attributing to the X-ray isolated cases of malnutrition or imbecility is as ridiculous as to ascribe the occurrence of club foot in a child to the fact that its mother had sprained her ankle during pregnancy. Many women who have never come near the apparatus have brought into the world similar children and even worse monstrosities.

Exposures in my cases were limited to seconds while Aschenheim's and others required minutes for their treatments. We wish to go on record as having given one patient twelve exposures totaling over 3,000 milliampere seconds during the last 2½ months of her pregnancy, without appreciable effect on her or her child.

Not a single instance of maldevelopment, physical or mental, has occurred in my series.

TOXEMIAS

We have found with others that in certain toxæmias of pregnancy it was possible to demonstrate focal infections in the sinuses and around the teeth which, when removed, greatly benefited the patient. As a prophylactic measure the X-ray plays an important rôle here as well as in medicine. In cases of hyperemesis treated with the duodenal tube, fluoroscopy will show whether or not the tube is in the duodenum.

MEDICOLEGAL

Operating for tumor and discovering pregnancy requires little comment other than that the physician is usually held liable. Avoidance of unsavory criticism and great expense can be accomplished by resorting to the X-ray when there is the slightest shadow of a doubt.

The medicolegal status of the X-ray in other fields has been established for a long time. In obstetrics its position is still questioned. On the basis of our experimentation, we believe that there is no ground for damages against the physician using it for diagnostic purposes should abortion, fœtal deformities, or failure to have more children, follow its use.

The following shows its importance as a means of protection for the obstetrician:

Within the past year a patient returned to the hospital about 2 months after delivery, claiming inability to walk because of pain in the pelvis. She had been told on arriving home, that she had a fracture of the right pubic bone and a dislocation of the right sacro-iliac joint, brought about by a forceps delivery. Both she and her husband claimed negligence on the part of the hospital and its staff. Immediate roentgenography settled this matter for all time. The pelvis was normal. The hospital and its staff were thereby spared unjust criticism and an incipient malpractice suit was laid low.

This brings us to Lynch's study of pelvic articulations during the latter part of pregnancy and labor. He reported and illustrated separation of the pelvic joints. My study shows this as a rather infrequent occurrence. The plates of Warnekros also show this infrequently, thereby proving that joint separation [illegible] The former because it does not always [illegible] and the latter because there is no resulting morbidity when it does occur.

[illegible]

Many in the profession rightly believe that there is more malpractice in obstetrics than in any other branch of medicine. There should be less. The science is rapidly developing. Newer methods are readily being recognized and adopted. There is still much hidden which time and further investigation will disclose. In the meantime there exists this valuable means of conserving maternal and fœtal life (many opponents notwithstanding).

The judicious use of the X-ray in our 250 cases at the Chicago Lying-in Hospital has revealed in the short time that it has been in use a great number of facts which would otherwise have been unrecognized.

Today we can show the student by plates what cannot possibly be demonstrated on the [illegible] We [illegible] himself can learn in [illegible] confrères in medicine and surgery have done; without discredit to his own diagnostic ability but with evidence of his progressiveness.

To Commander Raison of Great Lakes I express my gratitude for his assistance in my pelvimetry experiments.

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ADDISON'S DISEASE COMPLICATING PREGNANCY, LABOR, OR THE PUERPERIUM

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ADDISON'S disease is defined by Osler as a disease characterized by muscular and vascular asthenia, irritation of the stomach, and pigmentation of the skin, due either to tuberculosis or atrophy of the adrenals, or to degenerative changes in the chromaffin system generally.

The disease is fairly rare; it occurs less frequently in women than in men, in the proportion of 1 to 9. Only a few reports are found in literature of cases of Addison's disease complicating pregnancy or the puerperium, and in American medical literature I do not find the record of a single case. Altogether in the literature, there are reports of 11 cases, of which short histories are given below. To these I add a case recently observed by myself.

CASES OBSERVED DURING PREGNANCY

Case 1. Reported by Barlow, Lancet, Lond., 1885, i, 251. Patient, age 42, had suffered with the disease for ten months during which time she was pregnant and gave birth to a dead fœtus. The patient had lues of the suprarenals, verified at autopsy.

Case 2. Reported by Jacquet, in Brouardel's Traite de médecine, 1897, iii, 617, refers to a personal case of pregnancy occurring in the course of Addison's disease. Jacquet confines himself to saying that the child was born in good condition at term. During pregnancy pigmentation and other symptoms of Addison's disease were much accentuated, and after labor the points of election of gravidic melanoderma remained intensified. The further course of the disease in this patient is not known.

Case 3. Reported by Miller and Fleming, Brit. M. J., 1900, i, 1014. This was apparently a case of familial Addison's disease. The mother and five children all showed symptoms of the disease. The children in the order of their ages demonstrated all the clinical features in decreasing severity and distinctness. The woman stated that bronzing began after her first pregnancy and became intensified in successive pregnancies. She showed great weakness and prostration, giddiness, diarrhœa, vomiting, pain in the back shooting to the shoulders, palpitation, pain over heart and breathlessness, in addition to the pigmentation and the occurrence of dark moles all over the body.

Cases 4 and 5. Reported by French, Lancet, Lond., 1908, i, 1398. In French's first case the woman was 40 years old and a XI para. The symptoms of Addison's disease commenced about 6 months before she last became pregnant. There was nothing of note during the early months of pregnancy, but from the fourth month there was weakness of high grade, vomiting, and syncope. As these symptoms showed no signs of abatement the pregnancy was ended at the sixth month. After abortion the pulse rose rapidly, the heart weakened, there were convulsions, and the patient died the second day of the puerperium. Autopsy showed typical caseation of the suprarenal glands.

The second case was very similar according to French but he does not give any details. This patient died also.

Case 6. Reported by Vogt, Verhandl. d. Gesellsch. f. Gynaek., 1913, xv, 115; 249. Woman aged 21 years, primipara. Onset of disease unknown. Course of pregnancy normal. Labor began in thirty-fifth week and it lasted 21 hours, one hour of which was due to the secundines. The fœtus was well developed as an 8-months fœtus, 47 centimeters long and weighing 2,250 grams. The child was living at time of report, being then 14 years old and showed no symptoms of the maternal disease. Like the pregnancy, the birth was without incident, and uterine and abdominal contractions left nothing to be desired. The secundines were discharged normally one hour after birth. No uterine inertia was observed either during or after birth. The puerperium proceeded well for the first 2 days, there was then a sudden thermal elevation the third day, which continued. On the eleventh day vomiting began and could not be controlled, causing collapse and death of the patient on the twelfth day. Autopsy showed both suprarenal capsules caseous, with general anæmia, atrophy of the heart, hyperplasia of the aorta, etc.

Case 7. Reported by Seitz, Inneren Sekretionen und Schwangerschaft, 1913, Barth, p. 191. Woman, age 30, on account of great weakness and augmented pigmentation was suspected of disturbance of the suprarenal glands. In her first pregnancy this woman had shown intense pigmentation of all the body, especially of the genital regions, and this did not quite disappear after the birth. In a new pregnancy, 9 months afterward, the intense pigmentation spread to the arms, trunk, and legs. The bronze color was unaltered a year after the birth.

Case 8. Reported by Guisti, Rassegna d'ostet. e ginec., 1914, xxiii, 465. Primipara; tubercular; 4 months pregnant. The first two months of pregnancy had a normal course. Toward the end of second month mucous and alimentary vomiting, intense gastric crises and general asthenia; face

dark colored; intense pigmentation; asthenia progressively increased. The patient could not stand even for a short time. Blood pressure 100 millimeters. Slight albumin in urine. Diagnosed as pregnancy complicated by Addison's disease. Tubercular reaction positive. Spontaneous abortion at sixth month with dead fœtus weighing [illegible] grams. Secundines normal. The patient's condition was very grave at the beginning of the abortion, rapidly grew worse, and she died a few days later. No autopsy. The Addison's disease, the author believes, began during pregnancy and he ascribes the suprarenal lesions to tuberculosis.

Case 9. Reported by Falco, Rassegna d'ostet. e ginec., 1915, xxiii, 134. Age [illegible] years. XI para. History of disturbed and scanty menstruation. The cephalæa, gastric crises, lumbar and epigastric pains commonly observed in Addison's disease were frequent in this patient. Abnormal pigmentation. Blood examination: red blood cells, 3,800,000; white blood cells, 6,700; polynuclear neutrophiles, 60 per cent; eosinophiles, 1 per cent; basophiles, absent; small lymphocytes, 32 per cent; large mononuclears, 7 per cent. These findings are similar to those commonly observed in Addison patients. There was constant headache. Pulse 80 to 90, apyretic. Adrenalin was administered without result. The patient gave birth at term to a slightly asphyxiated child. The secundines came 5 minutes later and were normal. No inertia. Uterine and abdominal muscular contractions good. Fœtus weighed 2,820 grams. Lochiæ normal. First days of puerperium, temperature 38.5°, pulse 110-115. The woman nursed her child and left the hospital after 20 days with all the symptoms gone or improved, but 8 days later she died suddenly. There was no autopsy nor could any particulars be obtained of the symptoms before death occurred. The cutireaction for tuberculosis in this case was positive and the author thinks that the Addisonian symptoms were due to a tubercular lesion of the suprarenals. Syphilis may be ruled out.

Case 10. Reported by Roten, Gynæcol. helvet., Genève, 1915, xv, 113, says that one case of Addison's disease complicating pregnancy was observed at the Basle clinic, but does not give any particulars.

CASES OBSERVED IN THE PUERPERIUM

Case 11. Reported by Wilkin, Lancet, 1888, i, 498. Age 32; married 3 years; one child which died 3 weeks after birth. Patient has been ailing since birth of child. Examination showed severe epigastric pains, deeply bronzed skin with well-defined chocolate-colored spots about arms and neck, mucous discoloration of lips and cheeks, large dark patch on dorsum of tongue with smaller ones like ink stains. Alteration in her color only became apparent soon after birth of her child. No abdominal pains; great lassitude; and weakness, nausea and vomiting which became aggravated. Died after 3 weeks in bed. No autopsy.

My personal case is as follows:

Mrs. H[illegible] was admitted to Maternity Ward, Hahnemann Hospital, Chicago, June 4, 1921. Patient had usual children's diseases, malaria. The family history is negative. [illegible] The pains were regular and the course and delivery normal. Had [illegible] perineal laceration which was repaired with silk gut. Placenta expelled intact. Uterus contracted and involuted [illegible]

Condition remained good until about 20 hours postpartum. The temperature then rose suddenly from 99° to 102° and continued to rise very irregularly on the days following, reaching 105° on June 10. The condition was thought to be [illegible] metritis, secondary to [illegible]

[illegible] examining her then the prominent symptoms, besides the high temperature, were: (1) deep bronze color of the [illegible] (2) apparent [illegible] bulging [illegible] (3) dullness in the [illegible] of ideas in replying to questions; (3) dullness and sensitiveness over right kidney region; (4) area of dullness over the heart small; (5) abdomen, tympanitic, soft, irregular and sensitive.

The patient showed a systolic pressure of 66; diastolic of 52; pulse pressure 14, pulse 90; temperature 102; respirations 26; respiratory suspensions 25 seconds.

The clinical history showed nausea, continued severe [illegible] leg pains, weakness, restlessness, nervousness, giddiness, and inability to sleep; also marked lumbar region sensitiveness and pains.

From the bronze color, the manifest hyposuprarenalism and hypothyroidism, and the clinical history I diagnosed the case as puerperal septic absorption with Addison's disease. Adrenal and thyroid extracts were prescribed.

The temperature variations are shown in accompanying chart.

The administration of thyroid extract was discontinued June 18. Blood cultures were negative for [illegible] Vaginal smears and others gave some streptococci on culture. Wassermann reaction negative. Blood count: [illegible] hæmoglobin, 85 per cent; [illegible] mononuclears 1 per cent; neutrophiles 94 per cent.

The study of Addison's disease in pregnancy has an interest first on account of the connection of the suprarenal glands to the sexual apparatus. Disturbances in the glandular secretions cause irregularities or inhibition of menstruation or sterility. The exact mechanism of the suprarenal secretion on the ovarian

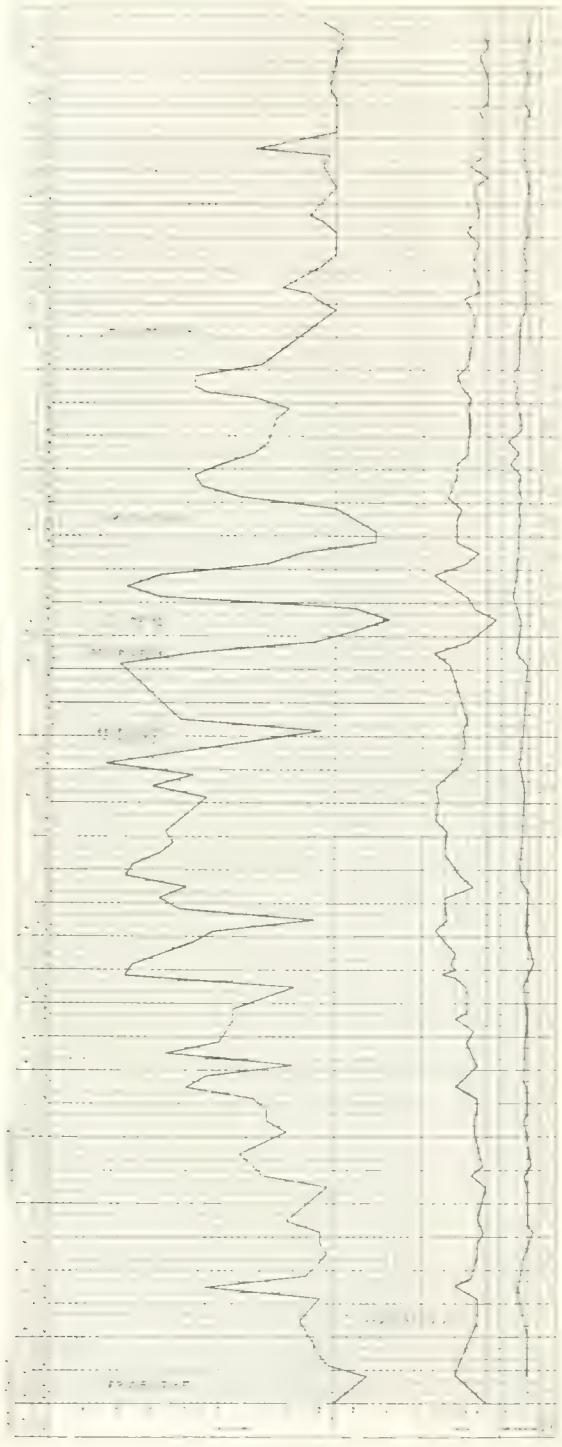

Chart showing temperature variations in author's case.

or other sexual function is not, however, well known. The matter is summarized in Novak's article in Nothnagel's *Specielle Pathologie*, 1912, Supp. vol. I. Physiopathology of the suprarenals has, furthermore, a special interest during pregnancy and the puerperium not only on account of the direct effects of the glandular functioning in these states, but on account of the reciprocal action of the gravid state upon the suprarenal functions. There seems to be little doubt that gravidity demands and effects superfunctioning of the suprarenals as of other glands connected with sexual activity in the cortical zone, though opinions are divided as to whether there is an increased or reduced secretive activity in the medullary zone. Some investigators have found an increased quantity of adrenalin in the blood of the gravid in all periods and attaining its maximum during labor. Others have not been able to substantiate such findings. Whether, in the case of atrophy of the suprarenals, other internal secretory glands act in a compensatory way to supply their particular secretion or to what extent is not known.

We will now consider the reciprocal effects of Addison's disease and pregnancy, labor, and the puerperium.

As regards pregnancy complicated by Addison's disease, cases may be divided into two groups, the first group comprising cases in which the pregnancy occurs in a woman already affected by the disease and the second group those cases in which the Addison's disease appears only in the course of the pregnancy. Guisti's case belongs to the latter type and those of Seitz, Miller and Fleming and the author are doubtful cases. Although the material on which to formulate an opinion is extremely scant, still from what is known and from the theoretical considerations, it would seem safe to assume that pregnancy does not of itself predispose to Addison's disease in a patient whose suprarenals are normal, but that where there is already existing some alteration in the glands pregnancy acts as a stimulus to render a latent Addison's disease manifest; or at least that the effects of faulty functioning of the glands at a time when they are expected to

do even extra work are more manifest in the organism of a pregnant than in a non-pregnant woman. This also applies to cases where pregnancy occurs in the course of Addison's disease, and the intensification of pigmentation and other symptoms during this period, as noted in several cases in the series, supports the view.

The toxins of pregnancy to which are added those produced by the changes in metabolism due to the lack of suprarenal secretion create an unfavorable state of things, debilitating or impeding the normal powers of defense of the organism and consequently accelerating any morbid process, such as a latent Addison's disease.

The influence which pregnancy, labor, and the puerperium exercise on Addison's disease is frankly bad if we judge by the effects in the series of cases quoted. In the 11 cases, 5 of the mothers died before they had reached term. All of these deaths apparently occurred within a short number of days after labor. In the fourth fatal case, the woman went to term but died suddenly 28 days after the birth. The results are evidently grave for the mother and the eventual history of some of the patients in this series is not known.

As regards the child: in Barlow's case the fœtus was dead; French's two cases were induced abortions with dead fœtus; in Vogt's case the child was prematurely born: Guisti's case was a spontaneous abortion with a dead fœtus. If the child lives to term, however, the prognosis is good.

In those who survived the gravid state there were intensifications of the symptoms in the puerperium. In Miller and Fleming's, Jacquet's and Seitz's cases intensification of pigmentation is distinctly mentioned.

From the series of recorded cases it may be deduced that Addison's disease already existing or becoming manifest in the course of pregnancy or of the puerperium has its already bad prognosis aggravated, and its symptomatology intensified.

It is not easy to estimate exactly the effects of Addison's disease on the course of pregnancy, labor, and the puerperium. Experiments on animals have shown that capsulectomy was followed by early abortion in gravid animals. Clinical observations, as in this series of cases, are too few to enable a definite opinion to be formed. While French's, Vogt's, and Guisti's cases ended in abortion, spontaneous or induced, all other cases apparently went to term. An unfavorable influence of Addison's disease on the course of pregnancy need only be anticipated if the disease is very advanced and the patient's general condition poor. In such cases, abortion or premature labor must be the rule, due rather to the general state than to the alteration in the suprarenal glands.

As regards the influence of Addison's disease during labor, in none of the recorded cases was there any noted disturbance during the birth. The uterine and abdominal muscular contractions were noted always as good and sufficient. There was no inertia. If adrenalin plays any important part in the mechanism of labor, the loss of suprarenal adrenalin during labor must have been compensated for in some other way.

The disease seems also to have had very little effect upon the course of the puerperium. The uterus involuted well and the lochiæ were normal in all cases where noted. But it is questionable how far the process of lactation was affected by the disease or how far lactation may have been a factor in the death of the mother, soon after the birth in cases where it occurred. Whatever may be the causes, the puerperal state and lactation seems to have a very damaging effect on the course of Addison's disease. I wish to draw particular attention to one symptom which I observed in my own case and which I do not find mentioned in other case reports. I refer to the drawling, slow speech and decreased mentality. The decreased power of the patient to grasp ideas was very marked.

In my own case the feature that at once struck me when I first saw the patient was the very typical bronze discoloration. The persistent headaches, nausea, and vomiting and the aching all over the body with the feeling of very great weakness, were all in keeping with a diagnosis of Addison's disease, and the subsequent rapid recovery from the symptoms after administration of adrenalin and thyroid extracts confirmed me in my

Her slow mentality and drawling answers might be considered as due to general asthenia.

Another point which greatly interested me was the abnormal nature of the temperature curve. A study of the temperature charts during the pyretic condition of the patient will show at once that it was not comparable to the ordinary temperature findings in cases of streptococcal or similar puerperal infections but that there was some abnormal factor in this patient's case.

In only 3 of the cases was Addison's disease verified by the anatomical findings on autopsy, viz., in the cases of Barlow, Vogt, and French (first case).

As a practical conclusion, we might seek to know what should be the obstetrical conduct to follow in a case of pregnancy complicated by Addison's disease. As stated already, the disease itself has apparently very little influence on pregnancy, labor, or the puerperium, and when the general state of the patient is good, no interruption need be feared. But if the disease has already affected the general state in an advanced degree, the asthenia may be so great as to bring about a spontaneous abortion or to justify an induced one. The few cases on record do not permit any judgment to be formed as to the necessity for interruption of pregnancy. The maternal prognosis is in any case bad on account of the Addison disease itself which will presumably run its inevitable course. But the fœtal prognosis is good if the child lives to term or nearly so. The child of an Addisonian patient may be born prematurely or at term without showing any of the symptoms which threaten the life of its mother, and in Vogt's case the child has lived 14 years and is well. The obstetrical conduct in ordinary cases should be limited to the medical treatment justified and only to intervene when circumstances absolutely demand it. In the puerperium especially the obstetrician should seek to remove all possible causes which may render it pathological. Lactation ought to be forbidden, as it renders the patient weaker.

The patient has been followed since she left the hospital. The bronze coloration is still evident, especially in the facial region, less marked in the thoracic region, and with one particular spot on the abdomen.

There is epigastric pain easily elicited on pressure but which disappears when the manipulation is continued. In the lumbar region there is an exaggerated tendency to pain over the kidneys especially on deep respiration, and the patient is exquisitely sensitive to pressure over the lower lumbar area. There is some muscular and vascular asthenia.

I may add that the regional pains are not felt even on strong passive exercises of any kind made on the lower limbs. This points to the fact that the pains are dependent upon some deep-seated, rather than on a local, cause.

While any discussion in regard to the etiological factors connected with Addison's disease is outside the scope of this paper, I wish to say that the von Pirquet and complement-fixation tests for tuberculosis have so far given negative results.

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NOTE.—On June 8, 1917, the family physician, Dr. I. M. Bostick, reports the condition of my patient as follows: Blood pressure 110/70, 134, diastolic 84. The bronzing is still well in evidence upon the face and forehead. At times she complains of giddiness with some muscle asthenia and backache. She has steadily gained in weight. She had an attack of influenza in February, 1917, but has apparently recovered without any aggravation of her previous condition.

ADOLESCENT RICKETS

Report of a Case Operated upon and Cured by Osteotomy

BY PHILIP LEWIS, M.D.

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IT is the purpose of this paper to present briefly a discussion of this subject and to show the results obtained in 2 advanced cases: Case 1, a young lady of 23 with severe genu valgum; Case 2, a boy of 16 with genu varum.

Among those who have presented valuable articles should be mentioned Ollier; Goldthwaite, Painter, Osgood, and McCrudden; Poncet and Leriche; Tubby; Robert Jones; Elmslie; Muirhead Little; Lucas; Barber; *et al.* Since the publication of the excellent paper by Horwitz in 1909 there have been comparatively few contributions to the subject. Tubby states that late or recrudescent rickets has been described by Dedeyer and Ollier. Drewitt, in 1880, showed at the Pathological Society in London a case of active rickets in a boy aged 10 years the diagnosis being subsequently verified post mortem. Clutton reported the onset of a rachitic deformity in a girl between 10 and 11 years. He also reported a case in which the deformity came on at 12 years. Cautley had a case in a girl 11 years. She had rickets at 4 years and a recrudescence at 10. In 2 cases of Barlow and Berry the diagnosis was verified postmortem. Jenner referred to a case of rickets coming on in a girl of 19 years. Robert Jones showed a case at The Liverpool Medical Institute. Recrudescent, late, secondary, or protracted rickets is rare. Many deny there is such an entity as rickets originating at puberty and not a recrudescence. There is no *prima facie* reason against it. At this period of life the growth of the long bones has again become very active after a period of comparative quiescence, and, if errors of diet or endocrine disbalance exist, manifestations of rickets may reasonably be expected. Experience proves that cases free from rachitic history, yet showing anything like the generalized epiphyseal enlargements of the active stage of typical rickets, are [illegible] the liability to pro[illegible] whole growing period is accepted, the liability to the onset of the rickets during the same period must be granted. Researches of Mikulicz on the nature of the pathological processes in genu valgum point the same way, and McEwen's views support him. Perhaps the fairest statement which can be made at present is that, although the cessation of the rachitic process may be occasionally d[illegible] to later childhood or adolescence, the primary onset of the disease after infancy is still *sub judice*. It is incorrect to diagnose rickets from the presence of a single local deformity, and the signific[illegible] ria and late rachitic manifestations is obscure.

[illegible]

Age. Adolescent rickets, as its name implies, is rickets occurring during adoles[illegible] There is considerable discussion of the question as to whether it is a definite entity, that is a condition *de novo*, or a recrudescence of an infantile condition that has remained dormant during a period of comparative osteogenetic inactivity. In the 5 cases herein reported, the age of onset was [illegible]

Sex. [illegible] males are more prone to this affection than males. Females are more apt to develop scoliosis; males, deformities of the extremi[illegible]

Heredity. There is no definite evid[illegible] upon which to base an hereditary etiology.

Color. In contrast with infantile ri[illegible] none of the cases in this report occurred in a [illegible]

Nationality. It seems noteworthy that none of the present series of cases occurred [illegible] children of Italian, or Syrian parents, among which peoples so large a proportion of infantile rickets occurs.

Infection. In only 1 of the cases is there any mention of infection. That is, in Case 1 the knock knees were made worse by an attack of influenza. It appears to have had only a casual relationship.

Trauma is evidently of no great importance.

Metabolism. In the writer's opinion it is entirely a question of bone metabolism. However, the subject of metabolism is very closely allied with two important factors, viz., endocrinology and vitamines.

Endocrinology. It seems that there occur, at the time of sexual development, certain as yet somewhat indefinite changes in all the endocrine glands through the interrelationship and inter-activity of which there is produced a disturbance of osteogenesis resulting in deformity. The explanation of the exact nature of these changes is speculative. For example let us consider the case of the female. Until the age of 14 years all her endocrine glands are functioning normally and a "balance of power and effect" obtains. At the age of 14 her ovaries take on their normal function, develop, and add their internal secretion; and this disturbs the "balance." It is possible that excess of ovarian secretion stimulates the thyroid which in turn activates the parathyroids, thereby causing an increased output of calcium which renders the long bones softer and they bend.

Involution of the thymus coincides normally with adolescence, and disturbed thymus balance might cause bone and muscle changes.

PATHOLOGY

The pathology of adolescent rickets concerns itself practically entirely with the gross changes occurring locally in the parts affected, viz.: knees, hips, spine, feet. In case of renal dwarfism, the nephritis is important. As no tissue was removed from either operative case, no microscopic description can be given.

In genu valgum the inner condyle of the femur is markedly enlarged and the joint surface slants downward and medialward. In genu varum the opposite condition is found.

In genu valgum the muscles and capsule on the inner border are markedly stretched and weakened. The internal lateral ligament and crucial ligament are also relaxed. The corresponding tissues of the outer border of the joint are shortened. In genu varum the stretching and weakening are on the outer border of the knee. According to Keith's law of ligaments, no ligament is ever used for the continuous support of any joint or part.

If the muscles on the inner side of the knee give way, the strain falls on the internal lateral ligament, the ligament lengthens, as every unsupported ligament must do when subjected to continuous strain: so do the parts of the femur and tibia to which the ligament is attached. A small, then a larger, gap appears between the articular surfaces of the internal femoral condyle and inner tuberosity of the tibia. The condition of knock-knee is thus produced, because the abnormal strain on both the internal and external femoral condyles alters the rate of growth in the outer and inner portions of the epiphyseal lines. If, on the other hand, the outer muscular supports give way, a bow-leg is produced.

The primary cause of static deformities of the knee lies in a defect or change in the osseous system, but the structures which are immediately responsible for the deformity are the muscles around the joint. In a rachitic child the muscles are flabby and have lost their reflex tone, the ligaments of the knee joint have thrust upon them a static muscular function with the result that deformities occur. If these deformities are to be prevented, the lower extremities must be relieved of weight bearing until the bones have regained their normal health and rigidity. The reflex tone of a muscle depends upon its state of tension, which state depends upon the absolute rigidity of the bones on which they act. As soon as the normal bone rigidity has returned, the muscles resume their normal static, reflex function.

SYMPTOMS

Deformity. The symptom which brings the patient to the hospital is deformity: usually genu valgum or varum.

Pain. When the deformity has existed for some time, there may develop pain.

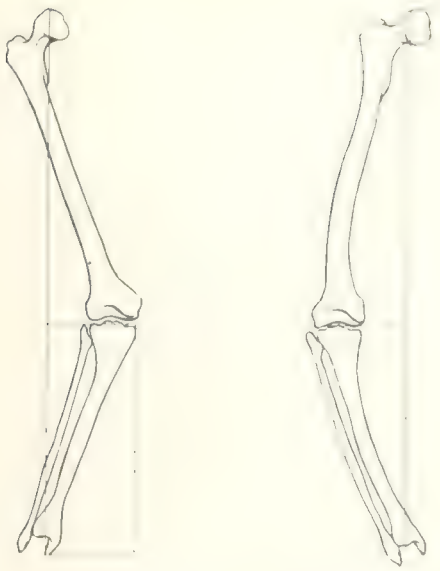

Fig. 1. Schematic drawing of genu valgum and of genu varum. (After McEwen.)

Weakness is due to the mechanical disturbance caused by the deformity.

Decrease in height is due to the deformity.

The cosmetic effect of the deformity especially in the girl is the inability to wear short skirts.

The X-ray clearly defines the deformity but the gross bony changes are not apparent.

DIAGNOSIS

The diagnosis is easy when a good history is obtainable and a physical examination is made, and the X-ray corroborates the diagnosis.

Osteomalacia occurs in older people. It is common in females and very rarely found in males. (See report of Kanavel, Elliott, and Nadler.) It is a generalized condition. There is marked absorption of lime salts as shown by X-ray.

Paget's disease (osteitis deformans) occurs in older people, usually past 40, and more commonly in males. It is usually a generalized condition, i.e., the following syndrome is present: bowing of a leg, increased size of the skull, cervicodorsal kyphosis, diamond shaped abdomen, simian type, and areas of absorption in the long bones as shown by the X-ray. (There is a monosteitic type.)

PROGNOSIS

The prognosis as to life is good. The writer has not found in the literature any statement to the effect that adolescent rickets shortens life. Barber warns against osteotomy in renal dwarfism because 1 case died 10 days after osteotomy. He believes uræmia is inevitable: in 7 fatal cases the ages were 11, 14, 14, 15, 15, 16, and 16. His oldest case alive is 20 years. Blood-urea determination and kidney function tests should be of value in making a prognosis in these cases.

As to correction of the deformity, the prognosis is very good.

TREATMENT

The writer's experience advises against the use of the osteoclast and recommends osteotomy.

Technique. The field of operation is carefully prepared on the preceding day. At the time of operation, another preparation is done and over the point selected a small incision is made and a chisel (not an osteotome, see Fig. 2) is inserted. This is worked back and forth parallel with the long axis of the bone until it pierces the periosteum. Then, with the chisel pressed very firmly against the cortex, the cutting edge is turned through an angle of 90 degrees until it lies transverse to the axis of the bone. A piece of gauze is wrapped around the chisel and the instrument held very firmly against the bone. By means of a mallet or a well-balanced potato masher the bone is chiselled about three-quarters the way through. The remainder of the fracture is accomplished manually. A green stick fracture is highly desirable. If a complete fracture is made it is important

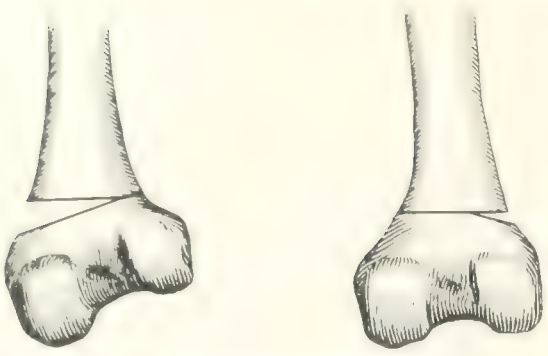

Fig. 3. Supracondylar osteotomy.

that the fragments be held so as to prevent prodding of the muscles, which is always a source of much discomfort. The wound is closed with catgut subcutaneously and either catgut, silkworm, or waxed silk cutaneously. Now the stockinette (which had been rolled up near the groin before the operation was started) is pulled down and the limb encased in a layer of sheet wadding and roller bandage. Felt pads protect the iliac crests, knees, malleoli, heels, and points of fracture, and a plaster-of-Paris cast is applied. As the cast sets, slight overcorrection of the deformity is obtained. If the fractures are above the knees a double spica is necessary; if below, the cast should extend from the perineum to the toes. The legs should be elevated in bed.

As part of routine these patients are given (1) phosphorus and cod-liver oil[1]—phosphori gr. 1/6, ol. morrhuæ ʒii—1 teaspoonful 3 times daily before meals; (2) a high vitamine diet containing as much of the following as possible: cream and butter, spinach, tomatoes, cabbage, onions, beets, beans, peas, turnips, carrots, orange juice, lemon juice, crisp bacon, fresh fruits. In this diet all 3 groups of vitamines are included: fat solubles (a) and (b), and water solubles (c). (3) As much sunlight and fresh air as possible.

Castration is usually not indicated. In extreme, acute case there might be a possible indication. This procedure has been recommended because of its value in some cases of osteomalacia.

[1] Phosphorized cod-liver oil is excellent because the dosage is more reliable.

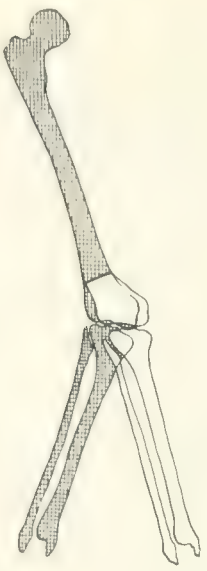

Fig. 4. Osteotomy of femur. (After Ollier.)

It seems rational to administer some of the endocrine glands in selected cases, especially thyroid and hypophysis.

Wolff's law. This law applies to adolescent rickets. Quoting from Freiberg's review of Wolff's article: "Every change in the form and function of the bones or of their function alone is followed by certain definite changes in their internal architecture, and equally definite secondary alterations of their external conformation in accordance with mathematical laws." In a few words it means, "function determines form." Therefore, after correction of the deformity, as recommended above, the internal and external forms of the bones become more normal.

Case 1. F. McD., white girl, age 23, born in Chicago, of Irish parentage, referred by Dr. James H. Hutton. Admitted to St. Luke's Hospital, February 20, 1921, complaining of knock-knees, pain in knees; difficulty in walking.

Patient has been told that she had rickets at the age of 3 years. She had no trouble with her legs until she was 12, when she began to menstruate. About this time she was compelled to lift heavy baskets of clothes and do heavy work. Then she noticed stiffness and pain in knees. When about 14 years she noticed she was getting knock-kneed. During this time she had stiffness and pain in knees and experienced difficulty in walking, at times finding it necessary to hold on to things as she

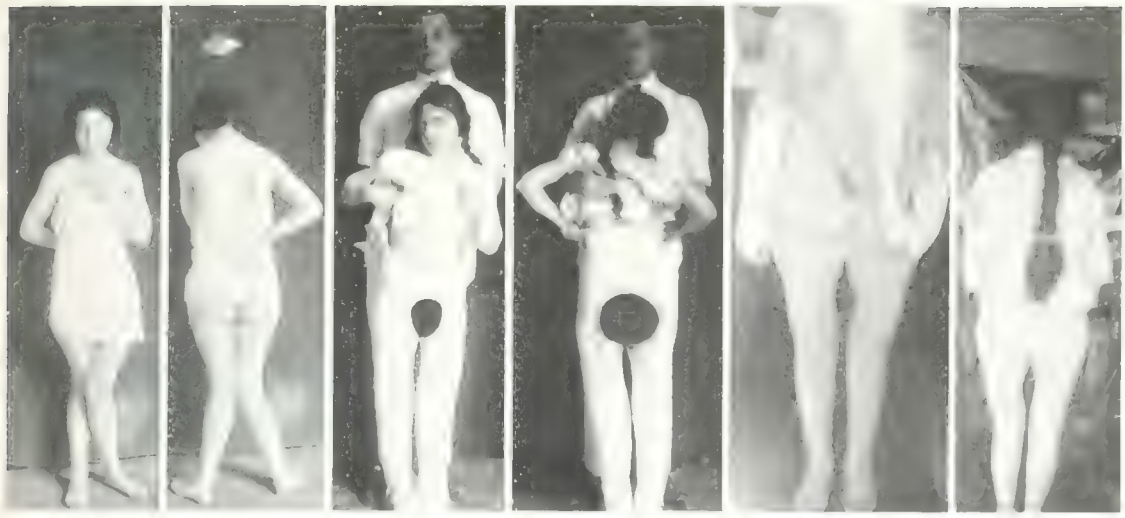

Fig. 5. Fig. 6. Fig. 9.

Fig. 5. Case 1. February 22, 1921, before operation.
Fig. 6. Rear view before operation.
Fig. 7. Case 1. April 15, 1921, 6 weeks after operation.
Fig. 9. Case 1. Five months after operation.
Fig. 10. Case 1. Five months after operation.

walked. From 14 until 21 years the stiffness and pain gradually disappeared and the knock-knees remained stationary. Two years ago she had a severe attack of influenza, since which time the pain has returned but there is no stiffness. She has become more knock-kneed, and walking is increasingly more difficult. The knees become so weak while walking that she is forced to rest.

Patient has had measles and rickets, and influenza 2 years ago. She has worn braces for her legs. Venereal infection is denied. Menses began at 12 and have been of the regular, 28-day type, duration 3 to 4 days. Dysmenorrhœa inconstant.

Patient knows very little of her family, which accounts for inability to give early history.

Patient uses tea and coffee but no alcohol. She frequently had diarrhœa in childhood but is troubled with constipation now. She has not been troubled with nocturia, with frequency, or with irritation. She weighed 117 but now weighs 103¾ pounds. She is 4 feet 9 inches tall.

Examination shows the upper extremities normal. There is a bilateral genu valgum of the lower extremities, much worse on the right side. When the internal femoral condyles are approximated, the malleoli are 11 inches apart. There is also bilateral hallux valgus of moderate degree.

On February 21, 1921, the urine showed albumin hyaline casts, red cells, and leucocytes. On February 22, 1921, a supracondylar osteotomy was done, and the femora placed in a double spica cast. On March 10, 1921, the patient rested on a stretcher in the yard. On April 28, 1921, she was discharged with casts on, to return in 1 month. She is about 2 inches taller than before the operation.

A roentgenogram on March 22, 1921, made by Dr. E. L. Jenkinson, showed an oblique fracture through lower third of left femur. The upper fragment displaced outward and slightly backward. There was a transverse fracture of the right femur in lower third. The upper fragment [illegible] slightly outward. Lateral position was very good.

Basal metabolism test showed +1.3.

Case 2. Joe G., white boy, age 16, born in Chicago of Polish parentage. Admitted to Cook County Hospital, October 28, 1920, complaining of bow-legs.

Patient states that he had "bow-legs" when a young child but that he outgrew them. A photograph of him at 13 years shows straight legs. At about 14 years of age when adolescence began he noticed that his legs were bowing. At this time he was doing heavy lifting as a grocery boy.) The condition has gradually increased ever since.

The past medical and surgical history is negative. The father, mother, brother, and sister are living and well; 2 sisters and 1 brother dead, cause unknown.

Patient attended public school until he reached seventh grade, at 14 years. He is employed in a factory and his work requires that he keep sitting position. He sleeps and eats well and has been increasing steadily in weight during past 2 years.

Physical examination shows a young white male of about 16 years, whose [illegible] normally developed.

There is a marked bowing of both legs, the right much worse than the left. The upper tibiæ are involved chiefly but the femora are also affected. While standing with heels and toes touching, the internal [illegible] of the right [illegible]

Fig. 11. Fig. 12. Fig. 13. Fig. 14. Fig. 15.

Fig. 11. Case 2. Legs straight at age of 15.
Fig. 12. Case 2. Showing large hand.
Fig. 13. Case 2. Before operation.
Fig. 14. Case 2. Standing alone, 6 weeks after operation.
Fig. 15. Same as Figure 14.

from the midline of the body, and the left is 2½ inches from that line. There is a 10-degree bilateral genu recurvatum. Decidedly pronated feet.

Movements are normal.

General examination reveals no pathology.

Diagnosis: Genu varum, genu recurvatum, pes planus.

X-ray examination shows:

1. No X-ray evidences of bone or joint changes in the several regions examined. The sella turcica seems very much flattened and shallow. No material increase or decrease is seen (Blaine).

2. No marked evidence of remaining rickets except the curvature of the long bones. The sagittal suture in anteroposterior projection does not seem to be firmly united. Longitudinal arches of feet are depressed (Blaine).

3. No evidence of the cause of the bow-legs. Bone densities are approximately normal.

4. Practically all the epiphyseal lines closed and the individual bones of the pelvis and lower extremities more than usually large. A certain coarseness of appearance is noted. No localized bone changes are observed (Blaine).

5. After operation, apposition of fragments good. There is an equal degree of slight internal angulation at the point of each fracture (Matthews).

July 12, 1921. Metabolism test normal.

July 22, 1921. Operation. Open osteotomy of tibiæ. Plaster-of-Paris casts. Slight overcorrection.

Case 3. J. McC., white girl, age 22, born in Chicago, of Irish parentage. Seen at South Side Free Dispensary, Northwestern University Medical School. Until she was 16 years old her legs were normal. At that age she began to menstruate and knees began to bow. Comes for treatment of coccygodynia.

Case 4. R. F., white girl, age 17, born in Indiana, of Russian parentage. Entered St. Luke's Hospital on the service of Dr. John L. Porter (for whose permission to report this and the next case, I am very thankful). Genu varum was well marked. It was first noticed at age of 10 years. Her father is bow-legged also. Menses began at 13. Operation: Osteotomy of tibiæ and forcible correction.

Case 5. A. E. K., white boy, age 19, born in Chicago. Private patient of Dr. John L. Porter. Genu varum, left, well marked. General health and nutrition excellent. About 1 year previous to date of entrance he noticed that his left leg was "out of line." He had no explanation of the cause. At the onset of the trouble, there was some pain but this gradually disappeared until the present time when he has no complaint except the outward bowing of the left lower leg. He grew very rapidly during the past few years and simultaneously engaged strenuously in athletics in high school. A tentative diagnosis of either adolescent rickets or beginning monosteitic Paget's disease was made. X-rays made by Dr. Hollis E. Potter revealed elongation of the inner condyle of the left femur, but no other bone pathology. No operation indicated.

CONCLUSIONS

It is a very interesting fact that these deformities either make their appearance, or, if present, grow markedly worse, coin-

cident with adolescence. During this period increased demands are made on the organism, and if at that time the general metabolism and especially bone metabolism is disturbed, deformities are prone to occur. It is probable that a combination of bone softening, plus heavy lifting or carrying, causes some cases. Others are due to relaxation of muscles and ligaments, and in this type infections may be a causative factor.

Certain definite factors occurring at a certain definite "cycleogical" time. These factors are:

1. The growing period for that individual;
2. Athletic overindulgence, as seen in the high school boy;
3. Physical overwork, such as carrying heavy loads as in the case of the grocery boy, or the young girl doing domestic work which is too strenuous for her;
4. General food deficiency;
5. Particular food deficiency;
6. Stimulated endocrine activity;
7. Suppressed endocrine activity;
8. Disturbed endocrine activity, i.e., abnormal chemical secretions.

It is the writer's belief that the whole question is one of bone metabolism and especially calcium metabolism due to the above-mentioned factors, and the immediate cause of deformity is a disproportion between the carrying-power of the bones and the load they are forced to carry.

The writer believes that corrective measures should be instituted and that operation is not attended by unusual risk.

The writer desires to thank those whose names are mentioned in this paper and especially Dr. John L. Porter for the privilege of reporting Cases 4 and 5 and Dr. J. H. Hutton, Case 1.

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CHRONIC BONE ABSCESS

Its Treatment by Simple Evacuation through a Drill Hole

By WALTER M. BRICKNER, M.D., F.A.C.S., New York
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IN an earlier communication on "Chronic Medullary Abscess of the Long Bones" (1) I called attention to the facts that these abscesses, usually from residual foci of an antecedent osteomyelitis, often become sterile, and that such abscesses can be promptly cured by the minor operation of simply evacuating them through a small opening in the bone.

In that communication I said: "The medullary abscess, like acute suppuration of the bone marrow, cannot be recognized as such, roentgenographically. The roentgen-ray appearance is that of an osteoperiosteitis or of a bone that has been the seat of an osteomyelitis." The statement is not wholly correct. When, as sometimes happens, a considerable length of the medullary cavity is occupied by pus, there is nothing in its roentgenographic picture to show that its content is purulent. On the other hand, when the medullary cavity is invaded by osseous growth in such a manner as to surround an "island" of pus, such a central abscess will appear in the roentgenographic positive as a light area, by contrast with the shadow of the surrounding bone—unless, indeed, as may also happen, the latter is so thick and so dense that it obscures the picture of the cavity within it. Cortical abscesses, of course, usually show clearly in X-ray pictures.

The technique of my procedure, as developed, is as follows: Under nitrous oxide narcosis, an incision about 2 inches long is made through the skin and (except, for example, over the inner surface of the tibia) the underlying muscle is split, or retracted, to expose the periosteum. Through this and into the bone, at a point determined by roentgenogram or by the level of maximum tenderness, a drill about one-fourth inch in diameter is driven deep enough to permit the escape of pus. If, perchance, the situation of a small abscess has not been estimated sufficiently accurately for it to be thus tapped by the first opening, other drill holes can be made with little damage to the bone, or the surgeon may defer the completion of the operation to determine roentgenographically the relative levels of the abscess and his first drill hole. With the escape of pus the drill is removed and *nothing else is introduced into the bone*—no probe, curette, or gauze packing! A culture is made from the pus to determine what, if any, living organism it contains. A smear is also stained and examined at once. The purpose of the latter is that if, instead of few or no bacteria, many are found, the surgeon may, if he thinks it desirable, enlarge the bone opening or otherwise modify the procedure. A small drain of folded rubber dam is laid in the soft parts down to, but *not into*, the opening in the bone, and the wound is otherwise closed by sutures. A simple gauze dressing completes the operation.

The drain is to provide for any further escape of pus from the bone, and to act as a safety-valve in case of possible suppuration in the bone cavity or the soft parts caused by dormant organisms awakened to activity. It is removed, usually without replacement, in 3 or 4 days, i.e., as soon as discharge has practically ceased. The small opening in the soft parts is then allowed to close and, ordinarily, healing of the entire wound is complete in 10 days or less, but few of which, usually, are spent in bed. Contrast this with the prolonged disability and invalidism, not to speak of the scarring and deformity, of wide-open osteotomy and slow "healing from the bottom," with its inherent risks of sequestrum formation and secondary operations!

The pain of a chronic afebrile bone abscess which, with tenderness, is the sole subjective symptom, is relieved by evacuation of the pus through a drill hole, immediately, completely, and—as far as my observation of several

Fig. 1. Dr. A. B. Abscess in the lower end of the tibia twenty years after acute osteomyelitis. Note that there is very little sclerosis of surrounding bone.

Fig. [illegible] Dr. A. B. [illegible] the abscess through a small drill hole. Note that the cavity is not entirely obliterated.

years warrants me in saying it—permanently. Failure thus to relieve the pain suggests the presence of a second abscess; such was the condition in a case, treated by my method, reported to me by a colleague.

Failure of prompt healing of the soft parts will, of course, arise if there be infection either from the operation itself or from bacteria in the evacuated pus. I have had one such experience, but the infection, a mild one, subsided under wet dressings without further operation.

Since the publication of my previous article reports of recent operations for chronic bone abscess have been made by Bevan, by McWilliams, and by Bancroft.

Bevan (2) presented two adult cases of small deep, chronic bone abscess, both recognizable roentgenographically. One of these, in the tibia, followed an osteomyelitis 33 years before; the other, in the femur, appears to have been quite like Case I in my first paper and, like it, without antecedent history of bone or other infection. In both cases Bevan made a 5-inch incision, freely "gouged out" the bone, gouged and curetted the abscess cavity, flushed the wound with hydrogen peroxide and then with alcohol, and at once sewed the soft parts completely. In both cases these healed *per primam*. Both patients were kept in bed 10 days but it "requires another 5 or 6 weeks for the repair in the bone to be completed." The procedure is one Bevan had been employing for a long time.

McWilliams (3) reports a chronic central abscess of the tibia, with pain for 2 years, probably resulting from a stab wound of the bone a year earlier. Through a six-inch incision he chiselled a furrow 3 or 4 inches long, in densely sclerosed bone, down to the medullary cavity, from which he evacuated an abscess of the diameter of a quill and 3 inches in length. The upper part of the wound was closed by sutures, the lower part was left open for three Carrel tubes. On the fourth day of dakinization "no organisms were found in

smears." The wound was then entirely closed by secondary suture. It healed promptly and the patient was discharged, cured, on the twelfth day.

As compared with the generally practiced tedious treatment by open osteotomy and repeated gauze packing, both Bevan's and McWilliams' methods of treating chronic bone abscess are distinctly steps in advance. But that they both secured early healing—one after primary, the other after secondary, suture—confirms my faith in the rationale of the still simpler method that I have advocated. In the absence of any statement to the contrary, it is presumable that both of Bevan's patients were afebrile—as is so commonly the case in this affection. He mentions no smears from the pus and no cultures. It seems to me quite likely that he secured primary union, not because of his vigorous mechanical attack upon the bone and his chemical antiseptics, but because the abscesses were sterile. McWilliams' patient was also, presumably, afebrile. He refers to no smear examination of the pus and "the cultures taken at the time of the original operation were contaminated, so the causative organism is unknown." In his case, too, the abscess may well have been sterile or nearly so.

Bancroft (4) reports a small, chronic, medullary abscess in the upper third of the tibia, which, like McWilliams, he treated by dakinization—without, however, the important detail of secondary suture. In his case there had been a localized thickening of the bone for 17 years. The pain present at the outset of the disease soon ceased, but it had recurred in recent years, was intermittent, not severe, and not associated with tenderness. Bancroft chiselled through dense bone, evacuated thick pus from a cavity about 1 centimeter in diameter, curetted this cavity, trimmed off the overhanging bone, and sutured across the space the periosteum and the skin, leaving an opening in these tissues large enough for four Carrel tubes. How long these tubes were maintained in the wound is not stated. The patient left the hospital on the sixteenth day, but the discharge continued for another 3 weeks. In effect, Bancroft's treatment was by free osteotomy and continued drainage through a partially sutured wound. The pus in his case contained staphylococcus aureus in pure culture. Whether or not his patient had any febrile elevations he, too, does not state.

I am quite prepared to believe that chronic bone abscesses unassociated, over a limited period of observation, with any elevation of temperature, are not always sterile. But it seems safe to assume that their contained organisms are attenuated. We can hardly depend upon killing contaminating bacteria in the freshly cut surfaces of bone, muscle, fascia, and skin by a single treatment with hydrogen peroxide and alcohol.

In McWilliams' case there was no tenderness, and no abscess was shown by the roentgenogram. It did show, however, a fusiform thickening of the bone 3 inches long. Since the abscess within it was also 3 inches long, it could have been tapped at any level in that area—a procedure which seems to me preferable, in these cases, to the osteotomies performed by McWilliams and by Bevan, with their greater risks of later trouble.

Simple evacuation through a drill hole is not at all suitable, of course, for those cases of non-discharging bone suppuration with high fever. In these cases we are dealing, in my experience, no longer with a "chronic bone abscess," if at all, but with a (recrudescent) acute osteomyelitis. At any rate, the process is a virulent one and demands vigorous surgical attack. Whether the method is suitable for chronic typhoid abscess I do not know.

How far it is applicable to those cases of chronic bone abscess in which clinical signs—daily mild elevation of temperature, slowly increasing pain and tenderness—indicate that the pus is not sterile but that the virulence of the organisms is slight, my experience is too limited to say. It has been sufficient, however, to make me offer the suggestion that in these cases simple evacuation through a small opening is well worth a trial, provided the patient is under close observation. It must be remembered that, although the bone opening is relatively small, drainage is provided. The following case is illustrative:

Dr. A. B., dentist, age 32, referred to me August 4, 1920, by Dr. Philip Hirtenstein, was operated upon at the age of 11 for acute osteomyelitis of the left

tibia. The disease left the bone irregularly thick[illegible] and fixed by osseous ankylosis to the femur, at which level there was a small cavity discharging from time to time through two sinuses.

For a fortnight Dr. B. had noted gradually increasing pain and "heat" in the region of the lower end of the left tibia. There was localized tenderness on pressure over the inner aspect of the expanded lower end of the tibia, suggesting the diagnosis of chronic bone abscess. The noon temperature that day was 99.5°.

On August 13 he arranged to enter Mt. Sinai Hospital. During August 13 to 15 it was noted that the evening (rectal) temperature was 100.5°–101°, that the pain had somewhat increased and that there was, as before, a point of great tenderness when the inner surface of the tibia was pressed upon 2 inches above the tip of the malleolus. Roentgenograms showed the familiar picture of a long bone that has been the seat of an extensive osteomyelitis. Much of the medullary cavity, especially in the lower half, was invaded by bone, but in the lower end, at the level of the area of tenderness, was seen, in the center, a somewhat irregular cavity about the size of a Jordan almond. This confirmed the diagnosis of abscess. It was interesting to note that the bone adjacent to the cavity showed only *very slightly* increased density posteriorly; elsewhere the [illegible] circumferential to the abscess and, indeed, in a considerable area beyond, was of normal density and its markings appeared very clearly (Fig. 1.). There was slight periosteal thickening over the shaft of the bone posteriorly, probably old, for it is still present (Fig. 2.).

August 16, operation. An incision about one-and-a-half inches long was made over the inner aspect of the lower end of the tibia, and the tendons retracted. At the point determined by roentgenogram and by maximum tenderness, a one-eighth inch drill was driven to the center of the bone. Thick pus escaped. Smears showed that it contained a few cocci; and cultures developed a pure growth of staphylococcus aureus. Tincture of iodine was injected into the cavity. The middle of the skin wound was left unsutured; since the bone is here subcutaneous, no drain was needed. Wet dressing.

For 2 days succeeding the operation the evening temperature was 103°, the lower leg was moderately swollen (there was a distressing iodine skin reaction), and there was slight purulent discharge from the wound. During the next 2 days the temperature fell gradually to normal, where it remained, the swelling disappeared, and the suppuration ceased.

On September 9 the patient left the hospital, walking. The wound was then small and granulating normally. It contracted to a granulating, practically dry sinus, leading into the bone. This remained until, about 9 weeks after the operation, there [illegible] thin, small, circular sequestrum, which had formed about the drill opening. The sinus then promptly closed and has remained healed. There has been no recurrence of symptoms. A roentgenogram made 18 months after operation shows that the drill hole is [illegible] shadow is unch[illegible]

McWilliams makes no mention of my method of treating chronic bone abscess, and refers to my earlier communication, which dealt only with the medullary type, as an "article on Brodie's abscess." On the basis of Brodie's description he is quite justified in doing so. Several generations of medical students have been taught, however, to think of Brodie's abscess as a circumscribed collection of pus in the bone cortex, usually near the epiphysis. To apply the term without distinction to all chronic non-discharging pus pockets, in whatever part of the bone, may serve only to obscure the student's conception of the disease. It seems to me better to speak of "cortical abscess," which is pictured in all the text[illegible] as Brodie's abscess, and "medullary" or "central abscess," to which but few textbooks even refer. Indeed, in the latest, very recent edition of his work on *Surgical Pathology*, Sir Anthony Bowlby again makes the statement: "Chronic abscess is never met with in the shafts, but always in the cancellous tissue of the epiphysial ends." We should eliminate from our future textbooks the statement that Brodie's abscess is usually tuberculous. It is of a piece with the lingering notion that fistula-in-ano is commonly tuberculous.

Concerning the pathogenesis and pathology of chronic bone abscess there is much that is debatable. The pain is, presumably, due to the pressure of the pus, since it disappears as soon as this is drained. If, however, the abscess was present before it caused pain, what produces increased tension at a time when no organisms are recoverable from the pus? It seems to me more likely that the pain begins when pus is formed in a cavity containing dormant bacteria and, perhaps, granulation tissue. This finds support in the pathology of chronic bone abscess as explained by Alexis [illegible] He studied three specimens secured by amputation and by resection, and describes: a *quiescent stage* in which "the lesion is represented by a minute cavity in the bone, filled with serum, and

lined by a well-defined membrane resembling the periosteum of young bones," the latter developed from granulation tissue which, at the outset had at once walled in the invading staphylococci; a *mature stage* or *stage of abscess*, "the lining membrane becoming again converted into granulation tissue and the serous contents transformed into pus, from which the staphylococcus aureus can be isolated"; and a *stage of perforation* and external discharge. The last is not often encountered. Thompson explains fluctuations in the pain in the "stage of abscess" by variations in the relative production of pus and erosion of bone to accommodate it. He describes, however, only an active process and makes no reference to abscesses that have become sterile.

If the onset of pain signifies the recent formation of pus then the case above reported should be regarded as having been, at the time of the operation, a *subacute*, rather than a *chronic* abscess. It seems reasonable to say, also, that this patient's infection might have developed into a very active process or subsided, leaving a chronic, sterile abscess.

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REPAIR OF TENDONS IN THE FINGERS

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ONE of the most baffling problems in surgery is to restore normal function to a finger in which the tendons have been injured. When we consider that the majority of industrial disabilities are from injuries of the hands, and that a successful repair of an injured finger tendon is a rarity, it is apparent that there are especial attendant difficulties, which cannot be overcome by the ordinary surgical procedure.

Before considering these difficulties and formulating methods of overcoming them, let us think of the hand as a marvelously functionating piece of live machinery and regard it with due respect. Though its tissues are tough and compact, its tendons, tendon sheaths, pulleys, joint surfaces and flexible joint capsules all glide on each other so easily and smoothly that there is little in the refinement of motion that the hand cannot do. If infection or trauma insults these perfected parts, a tissue reaction will occur, which will bind the gliding surfaces together, thicken and stiffen the joint capsules, congeal the tissues of the finger, strangulate the nerves and vessels, and loss of function will result.

Atraumatic technique essential. Surgical trauma so brutalizes the tissues and lowers their vitality that they are an easy prey for the few bacteria that even in spite of careful asepsis are unavoidably present. In most repairs of finger tendons free grafts are put in and as these have such a low resistance to infection, it is imperative that in these cases we use not only superasepsis, but also an atraumatic technique. If we are to avoid binding adhesions, we must not have infection even in its milder form of inflammation, in which no pus is formed, nor must we have aseptic traumatic inflammation, as this reaction to pure trauma is almost as binding to movable parts as is the fibrosis of infection.

As binding fibrosis is our arch enemy and trauma is both its direct and by predisposing to infection its indirect cause, we must if we

are to achieve success in repairing tendons of the fingers adopt an atraumatic technique.

Handling of the tissues should be reduced to a minimum and really to do this is surprisingly difficult. Every time the tissue is touched a traumatism results. If we keep the delicate histological structure always in mind, we will realize the necessity of never pinching or pulling the tissues to the degree of even microscopic tissue strain. The most gentle retraction and sharpest knife-edge dissection is not showing too great a respect for tissues, even if they are at some distance from the tendon. When handling a tendon or sheath, never should even a tiny scratch be made in the delicate membrane covering their surfaces, as here adhesions will form and prevent gliding. If we operate in a field rendered bloodless by the use of a blood-pressure band as a tourniquet, we may avoid the unnecessary trauma of sponging and can by clearly seeing the tissues dissect with exactness and a minimum of traumatism.

In a former paper[1] I have endeavored to formulate the methods and principles whereby we will meet with better success in reconstructing damaged movable parts.

Reconstruction of gliding mechanism. A tendon alone in the tissues cannot functionate as it will be bound by adhesions. To permit movement back and forth a tendon must have in addition a gliding mechanism. To Dr. Leo Mayer[2] and to Professor Biesalski is due the credit of giving us the exact anatomy of tendons and their gliding mechanisms, and the physiological method of transposing tendons, especially in the foot. They have shown how a tendon in the straight part of its course is surrounded by a loose fatty tissue called paratenon which is pulled back and forth in its central zone with the movements of the tendon, and that wherever a tendon turns a corner it runs in a true sheath, in which the surface of the tendon (epitenon) slips freely in contact with the synovial lining surface of the sheath. In other parts of the body a bloodvessel-bearing mesotenon is present throughout the length of the sheath,

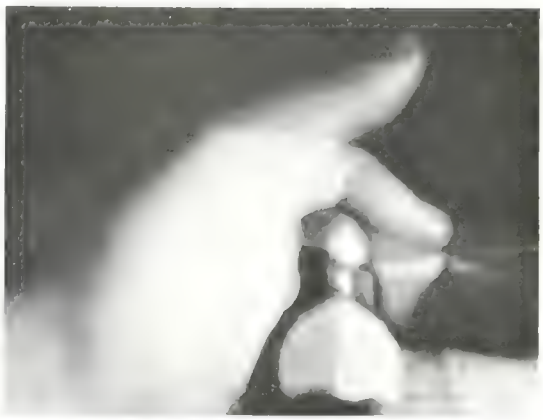


Fig. 1. Case B. [illegible] cut half way across [illegible] bottle covering these tendons. [illegible] physiatrist 1 hour later. [illegible] Power of flexor of last joint [illegible]

Operation. Flexor tendon was found to be densely adherent for [illegible] diameter. The adhesions and scar tissue were excised, the tendon was pared down to its normal diameter and a free graft of [illegible] the triceps tendon and parted [illegible] in the thumb.

The double photographic exposure shows the degree of function obtained August 9, 1920.

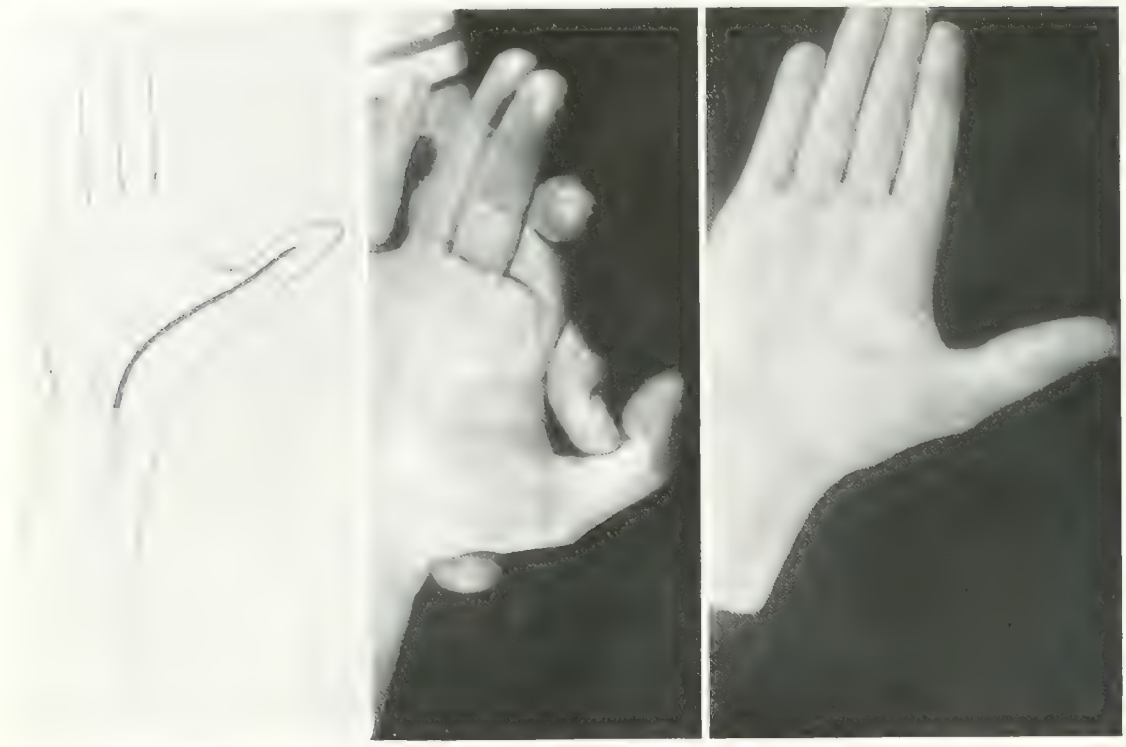
much like a mesentery, but in the fingers this is absent, being reduced to the two strands of tissue known as ligamentum breve and ligamentum longum.

In repairing an old injury of a flexor tendon of a finger it is not practical to suture the tendon within the finger. In the gap between the tendon ends the sheath will have become obliterated and there is not room in a finger to envelope the suture line with a sufficiently thick free graft of fat to allow motion. The exception to this rule is where the tendon is severed in the less usual site opposite the middle phalanx or distally, where the repaired portion need pull through but one joint, in which case a fair result can be obtained. Where the suture line pulls through two joints, it is necessary to remove entirely the damaged tendon from the finger and to replace it with a free tendon graft. The suturing of the tendon can then be done at its insertion and in the palm or forearm where adhesions will do less harm.

If the sheath of the tendon has been damaged, the new tendon will not slip and it will

[illegible] California St. J. Med., 1921, May.

[2] The physiological method of tendon transplantation. [illegible] bibliography. Surg., Gynec. & Obst., 1918, vol. [illegible]



a *b* *c*

Fig. 2. Case Mrs L. F. Two months previously the flexor tendon was severed at the base of the thumb on a piece of crockery, resulting in complete loss of power of flexion of the distal joint of the thumb.

Operation. The proximal end of the flexor tendon was, with the aid of strippers, withdrawn through an incision in the forearm and cut off at the wrist. The distal end of the tendon was removed through an L-shaped incision in the thumb. A free graft of the tendon of the palmaris longus was used to bridge the gap, as shown in *a*.

b and *c* taken 6 months later show degree of function restored to thumb.

be necessary to graft not only a tendon but a gliding mechanism complete. This means a tendon plus its sheath or a tendon plus its paratenon. The placing of both a sublimis and a profundus flexor tendon in the finger is too complicated. It is found sufficient to sacrifice the sublimis and use the profundus tendon only. The prevention of adhesions by the use of foreign bodies, as cargile membrane, etc., has long since been discarded, nor can a silk thread act as a substitute for a tendon in a finger.

Free tendon grafts cause less reaction than foreign bodies. They subsist on the surrounding lymph until they obtain their own blood supply. Often I have uncovered these grafts at short and long periods afterward. At first they show a slight swelling, but later show their original size and appearance and practically are none the worse from the transplanting. Some have even lived through infection. Function keeps a tendon in good condition, just as with bones, and a tendon with all its blood supply, if left without an insertion, will become yellowish and friable.

Sources of free tendon grafts. Grafts are easily obtained from the sublimis tendon, the palmaris longus, the long extensors of the toes, tubularized triceps, fascia lata, and many other sources. If the sublimis tendon of the same finger is used its upper end may be detached through a transverse incision, 1 centimeter long, in the forearm. It is well here to attach the distal end of the sublimis muscle to the profundus tendon for added strength. The incision is short and transverse for cosmetic reasons and to make a shorter distance for adhesions to form along a tendon in the

a *b*

Fig. 3. Case W. Z. Seven months previously, while opening a glass jar, the flexor tendon was severed at the base of the thumb. Power of voluntary flexion of the distal joint of the thumb was completely lost and that of the proximal joint was partially lost, greatly hindering his work as a cook.

Operation. The proximal portion of the tendon was found to be coiled up in a rounded mass an inch above the wrist and to have become yellowish and friable. After uncoiling the tendon and removing the [illegible] distal end of the tendon [illegible] in the thumb [illegible] in the tendon to unite. [illegible] from the palmaris longus, including the tendon plus its paratenon, as shown in [illegible].

[illegible] and taken [illegible] month later [illegible] function restored to the distal joint of the thumb.

The proximal joint functionates normally, though not flexed in the photograph.

forearm. If the palmaris longus tendon plus its paratenon is used, it will be necessary to make a longitudinal incision the full length of the graft. A long extensor tendon of the toes plus its paratenon in the dorsum of the foot can be taken without getting toe-drop, as the extensor brevis digitorum will serve to extend the toes. If a very long-branched tendon be desired, the extensor tendons to the second, third, and fourth toes can be used. They converge to form the inner tendon of the extensor communis digitorum above the annular ligament and can be severed here and at the toes. The outer tendon of this muscle (to the fifth toe and peroneus tertius) and the tibialis anticus will prevent foot-drop. It is necessary, however, to strip off the paratenon in the foot before these long tendons can be withdrawn.

If the paratenon is not removed intact with the tendon graft, paratenon fat may be gathered from elsewhere and planted sleeve-like about the tendon graft or other tendon to be mobilized. The fat over the triceps tendon is well suited for this purpose. Paratenon fat is specialized fat and differs much from the tough, short-fibered, subcutaneous fat. It is elastic and pliable and can easily be drawn a long distance back and forth from its moorings, as can be seen by comparing the mobility of the skin over the triceps tendon with that over the outer side of the arm.

Method of suture. The suturing of a tendon must be very strong, as it must stand the strain for the 5 weeks necessary for the physiological union to be complete. The stronger the suturing, the more forceful and continuous can be the all-important, postoperative exer

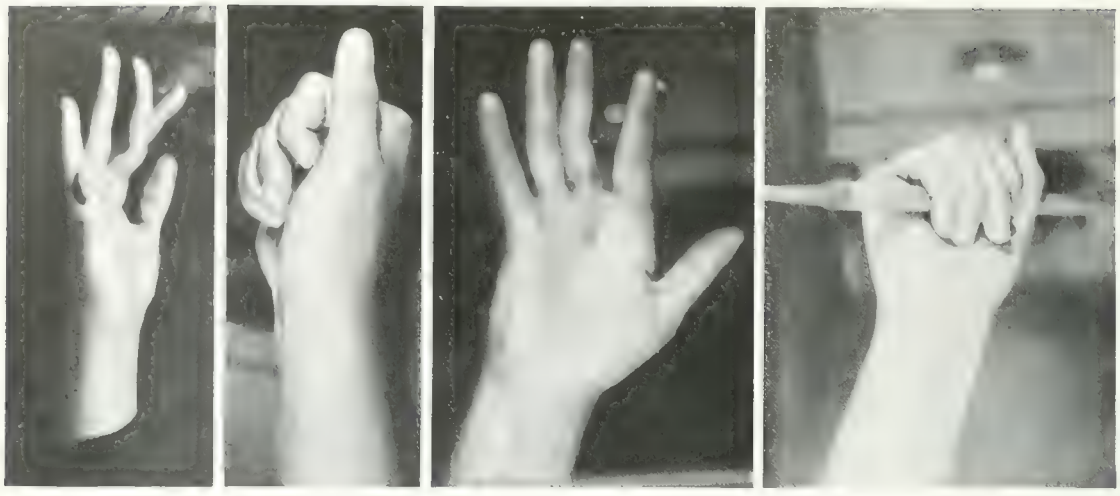


Fig. 4. Case Miss R. K. Four years previously the flexor tendons of the long finger had been severed with a knife over the proximal phalanx, resulting in complete loss of voluntary flexion in the last two joints and most of that in the proximal joint and in the deformity shown in *a*.

Operation. Through an incision in the wrist the sublimis and profundus tendons of the long finger were freed with a stripper to the far end of the palm, where they blended to scar tissue, and were drawn out of the arm. Through an L-shaped incision in the distal crease of the finger the distal end of the profundus tendon was stripped down through the finger until it tapered out. It was withdrawn from the finger and cut off. The sublimis tendon was cut off high in the forearm. With the expanded probe a channel was dilated in the finger and the free graft of the sublimis tendon was drawn through and used to bridge the gap in the profundus tendon, as shown in *b*. *c* and *d* taken 4 months later show the amount of function restored to the finger.

cise. The suture must be braided into the tendon for quite a distance and as little as possible of it exposed to the surface. The knots should be buried. If sewed well, the tendon will break before the suturing will. Any crude handling of the tendon, such as by grasping it with tissue forceps, will result in fraying of the tendon and in scratching and tearing the delicate covering or epitenon, and binding adhesions will result. Therefore, I use a specially devised fenestrated clamp and sew through the slits, making an even machine-sewed union and inflicting minimum trauma to the tendon. This I have described in a former paper.[1] Short tendon grafts may be threaded longitudinally on the two strands of thread. The suture material should be soft, slender, and strong. Pagenstecher is too harsh and will sometimes be extruded. Turner patent ligature silk Nos. 1 and 2 is satisfactory and often on exposing the union months later the suture line and silk cannot be seen. A good method is to let the suturing embrace only the half of the diameter of the tendon away from the mesotenon, so that at least the other half of the diameter of the

[1] Repair of tendons in the fingers and description of two new instruments. Surg., Gynec. & Obst., 1918, xxvi, 1.

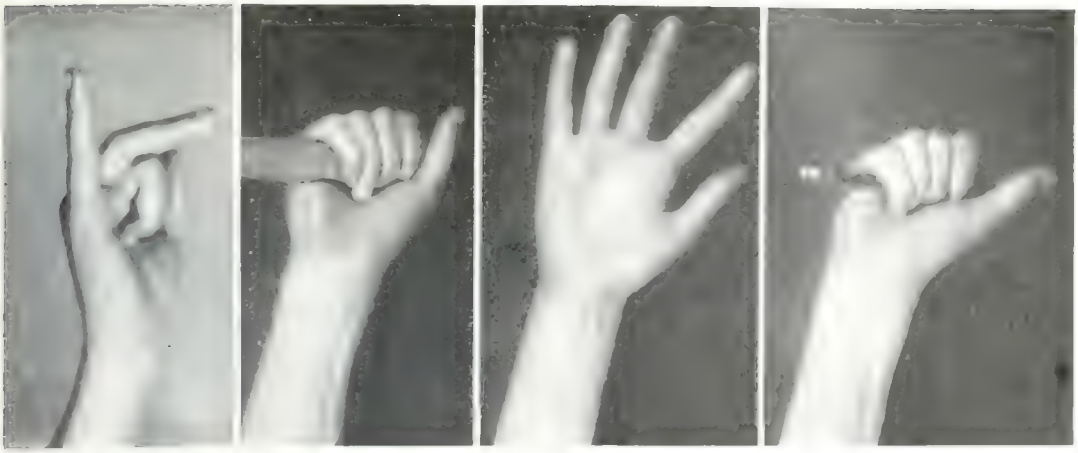


Fig. 5. Case Miss M. D. C. [illegible] knife severed the flexor tendons of the ring and little fingers over the middle of the proximal phalanges. [illegible] shown the limit of voluntary flexion in these two fingers.

of each finger had been destroyed. As sub

forearm, drawn through this paratenon raft to bridge

the little finger, the tendon of the palmaris

ply the defect in the profundus tendon. Its sublimis tendon was cut off. All tendon suturing was done

now practically normal function restored to hand.

tendon may be unhindered by suture material from making a perfect union. If the union be made in a region such as the forearm, where adhesions are not of such importance, it is well to overlap the cut surfaces of the tendon ends, so as to attain earlier and stronger union for early exercise. The proper tension for uniting a tendon has been worked out by Dr. Leo Mayer, as follows: When the origin and insertion of the muscle are approximated as near together as possible the tension of the tendon should be zero. There is an exception to this rule, however, in the case of a muscle which, owing to the severance of its tendon, has long been contracted. If the rule be followed in this case, it will not be possible to extend the muscle sufficiently for full function, and it will be necessary to make our tendon graft a little longer.

Removing and replacing tendons. It is difficult to remove a tendon neatly from a mass of adhesions and especially from beneath the annular ligament and from within a finger. These are the places where infection does the most damage, as here the firm structures prevent swelling and ischæmia results, encouraging the ravages of the infection. For this purpose I use a stripper specially devised from a cork borer (see former paper) that with a sharp edge and twirling motion planes the tendon smoothly from its binding adhesions. Some of the strippers have flexible handles to fit the curve of a finger.

It is difficult also to place a tendon, with its paratenon, through a tunnel in the finger. This can be done with a flexible probe expanding flatly at its center, so as to widen the tunnel, and terminating posteriorly in a funnel

a *b*

Fig. 1. Case C. H. C. Fourteen years previously a buzz saw cut partially across his hand, entering the cleft between thumb and index finger and severing all of the flexor tendons of the fingers. A severe infection resulted, during which time all of the severed tendons sloughed out from the palm. The index finger had been amputated, joints of long finger were ankylosed and ring and little fingers bent backward at metacarpophalangeal joints. There was complete loss of power of flexion of the fingers, as shown in *a*.

c *d* *e*

Operation. After amputating the ankylosed long finger and excising much of the scar tissue from the palm, the tendon ends were found at the bases of the fingers and in the wrist. Four good tendons were found in the forearm. Two of these were cut off and used as free grafts to join the other two tendons in forearm to ends of flexor tendons in bases of ring and little fingers as shown in *b*.

Six months later the palm was re-opened. The tendon grafts were in good condition and the fat in the palm had improved. The flexor tendons were freed of adhesions and stripped down their full length to the finger tips. The finger joints were forced into full flexion. As the operation was being done under brachial plexus anæsthesia, the man could then flex his fingers well. Active motion postoperatively was persisted in.

In *c*, *d*, and *e* taken 3 months later is shown sufficient function to allow him to return to work for the first time in 15 years.

to receive the end of the tendon and draw it through. The sutures from the end of the tendon hook over a peg in a slit in the funnel. A thin rubber tube may envelope the paratenon until it is evenly placed in the finger, and then the tube can be withdrawn.

Freeing adherent tendons. Quite often after a tendon repair or an infection, or even after a general traumatism to the hand or a simple fracture of a phalanx, it is found that the joints can be passively, but not voluntarily, moved because of adhesions between the tendon and the surrounding tissue. If these adhesions are planed off from the tendon by a tendon stripper (mentioned above) and active motion be started at once and persisted in, a great gain or even the normal range of motion will be attained. If the adhesions are light, this may be accomplished through an incision in the forearm. The finger joints are forced into full flexion, and the tendons in the forearm are separately pulled, until suddenly the adhesions yield and full flexion of the finger can be made by pulling the tendon.

Often after a tendon repair it is necessary to do a second operation of freeing the tendon from adhesions. This is best deferred, however, for several months until the original postoperative induration has passed away, otherwise a summation of postoperative induration might defeat our purpose.

Incisions. The selection of the proper incisions is very important. Many fingers are permanently crippled by the median longitudinal incision. This cuts the pulleys, roughens and causes adhesions on the friction surface of both tendon and sheath and leads later to a contraction like that of Dupuytren. If the median longitudinal incision of the finger, whether on the dorsal or palmar sur-

b

a

Fig. 7. Case Mrs. J. M. A year previously she fell through a window severing most of the tendons and the median nerve in the right forearm. Two operations had been performed, uniting the tendons and nerve. Infection had taken place. There resulted a total loss of function of the hand. The thumb assumed the lateral position and had no power of flexion. Limits of voluntary flexion and extension of the fingers are shown in *a*.

Operation. The median nerve which had united was dissected from the dense scar that bound it. The tendons which were all held firmly in scar tissue [illegible] ring and little fingers. The sublimis of the index finger was, therefore, transposed to connect with their distal ends. It was found that the [illegible] joined to the distal end of the flexor carpi radialis and that the flexor carpi radialis had been severed [illegible] sublimis of the long finger and that portion of the tendon had been sewed to the ring finger. The other ends were much shortened and sewed [illegible] reated by overlapping and uniting the tissues. Then for each finger in turn all of its joints were [illegible] into full flexion and the respective tendon sewed [illegible] until the adhesions in the latter were [illegible]. When all the fingers could then be brought into full flexion by pulling the tendons at the forearm. What was lost in [illegible] flexion and held so by reversed cockup splint. Thumb maintained in a position of opposition [illegible] tion. Active postoperative motion was persisted in.

b, *c*, and *d* taken a year later show result. She was able to work and write a legible hand.

face, through the matrix or in the pulp, whether for infection or repair, be eliminated entirely from the surgeon's activities, many fingers will be saved from being permanently damaged. Even in the palm the longitudinal incision leads to contraction. It is far better to make transverse incisions in the palm in the line of the creases or L-shaped ones than longitudinal. In the finger lateral incisions between the two lateral nerves and arteries should be made. They should be interrupted so as not to cut the pulleys. As the pulleys are located at the center of the segments of the finger, the lateral incisions should be opposite the joints. Distally, near the insertion of the tendon, the incision may be L shaped, one arm running transversely across the volar surface of the finger. It is very important not to cut the nerves of the finger.

Fig. 8. Case Mrs. C. H. Showing method of correcting [illegible] contracture of [illegible] preparatory to [illegible] repair. [illegible] patient. [illegible] Thumb [illegible] over. Latter [illegible] and [illegible] position and held [illegible] splint. When [illegible] from abduction applied [illegible] Result.

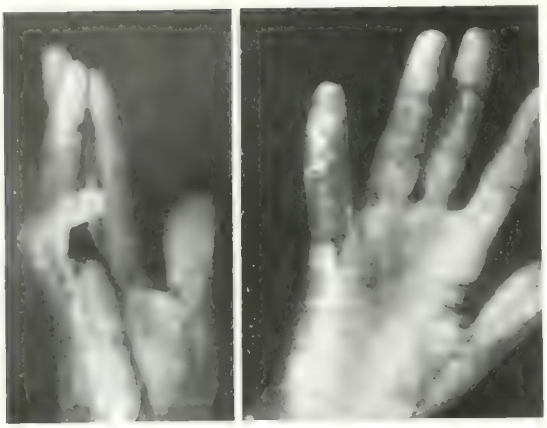


Fig. 9. Case R. W., colored. *a*, at left. Flexion contracture from gasoline burn. *b*, Same, after excision, hyperextension on splint, and skin graft by tubularized pedicle graft from side of chest.

either in the finger or in the palm, as trophic changes will result. On the extensor surface, crescent or L-shaped incisions are satisfactory. It is important to have the skin incision remote from the tendon graft and tendon suture, as otherwise adhesions and infection will be encouraged. If the pulleys have been destroyed by former ill-advised incisions, they may be reconstructed by fascial grafts. Otherwise the tendon will bow across the flexed finger and loss of function will result.

Flexion contracture of a finger. Flexion contracture of a finger is quite common, due either to suppurative tenosynovitis, or to the ill-advised median longitudinal incision. Mild forms may be corrected by using slow traction with a splint. A wire splint resembling a large safety pin, with two flat ends is laid longitudinally on the volar surface of the finger and with a web strap and buckle looped around each wire, the convexity of the finger is day by day gradually drawn forward between the wires until the finger is hyperextended. This position is maintained until the tissues of the volar surface of the finger have grown long enough to allow correction to be permanent.

Greater degrees of flexion contracture can be corrected by excising the contracting band of skin and subcutaneous tissue and after forcing the finger into overcorrection closing in the denuded area by a tubularized pedicle flap, prepared 10 days previously. Wolfe grafts

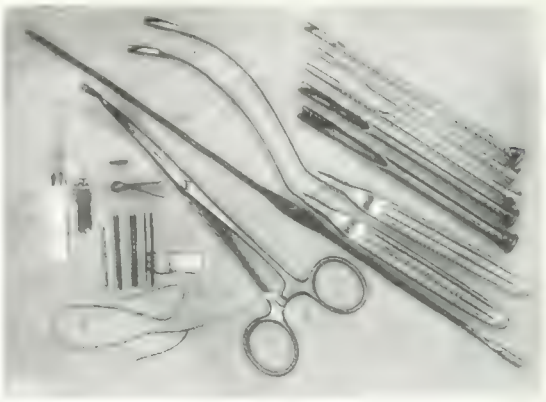


Fig. 10. Special instruments used in repairing tendons. *1* to *7* shows clamp used for suturing tendons, by which a perfect union may be obtained with minimum trauma.

1, is a punched-out matrix band of German silver, gauge 003, detempered at its center by passing through a flame. It is bent, as in *4*, by bending it about a rod and sliding over its two ends a sheath, *3*, as in *5*. In suturing the tendon the clamp is placed about the tendon end and made to hold it firmly by sliding the sheath up snugly and backing it up by a hæmostat, *7*, to be used as a handle. An 8-inch thread, *6*, with two needles is braided through the tendon by sewing through the slits of the clamp. The stitch is started by one needle entering just proximal to the clamp and running diagonally through the tendon and out the next slit. It is then made to encircle some of the tendon fibers and is again thrust through the tendon and out the next slit. At the third stitch the needle emerges from the end of the tendon. Starting at the other side of the tendon the other needle is similarly passed, so that both threads emerge from the end of the tendon. These are pulled firmly to take up all the slack, the clamp is removed, and the other tendon end receives its suture in the same manner. The threads of one tendon are tied each to those of the other, thus joining the tendons. The knots are buried between the tendon ends

Strippers are shown at *9* for freeing, with their sharp ends, the tendon from its binding adhesions. The tendon is held taut and the stripper is passed along it with a twirling motion, planing as it goes. Some have malleable handles, as *8*, for following the curve of a finger.

The flexible probe, *10*, is passed through the finger and its expanded center widens the channel for the reception of the tendon. The sutures from the end of the tendon are caught over the hook in the funnel at the tail end of the probe, so that the tendon end is drawn into the funnel and is drawn after the probe into its future bed.

may also be used, but they necessitate perfect immobilization. Thiersch grafts do not furnish enough subcutaneous loose tissue to make a bed for the later tendon repair. After straightening the finger hyperextension must be maintained for a month by splinting. If the contracture is too extreme, gangrene may result from sudden forced extension.

Indications and contra-indications. It is a mistake to attempt to mend a bone, correct a

contracture, or mobilize a stiffened joint in a finger at the same time that a tendon is repaired, as failure is sure to result. The added trauma will create adhesions to the tendon and also we will have the impossible double indication both to immobilize and move the finger. Unless the joints are freely movable, it is useless to repair the tendon, as it will not be able to move a stiff joint. The adhesions will then catch the tendon at rest and bind it in its bed.

If the joints of a finger are permanently stiffened, it is better to amputate the finger than to try to reconstruct it. Such joints have adhesions between their articular surfaces that will not allow movement, even after all the tissues, including the capsule of the joint, are cut away. If the stiffened joints are not permanently damaged, they may be drawn into the position of flexion by slow, mild, continuous traction on the ends of the gloved fingers. They will then become more easily mobilized, and the new tendon to be put in will have a chance to functionate. Intermittent strong forcing of the joints only results in straining them, which stiffens them all the more. Traction must be mild and kept up for a long time, so that the tissues will have time to grow enough to be relaxed in the new position, not merely stretched.

When the storm of an infection has passed through a finger and destroyed the flexor tendon, there often results a thin, red, shiny finger, with stiffened joints and firm congealed tissue. The contracted scar tissue throughout the finger has strangled the nerves and vessels, so that great trophic changes have resulted. Such a finger is unfit for repair of the tendons, and amputation is to be preferred. For a tendon repair to be worth while, the bed through which the tendon is to be placed must be soft and succulent. It may first be advisable to excise the damaged firm tissue and replace it by means of a tubularized pedicle skin-graft before tendon repair is done. To avoid latent infection and to await the softening up of the tissues, at least 4 months from the time of infection should elapse before a repair is attempted. A freshly cut tendon may be repaired primarily if an excision of the damaged tissue is done, but if over 24 hours have elapsed since the injury, infection will probably result if the tendon is operated on. One had better treat it conservatively and later do a secondary repair.

It is well to beware of an annular scar, or the too close proximity of another scar, as in such a case necrosis is prone to occur from the diminished nerve and blood supply.

There are certain people, and not always old ones, whose joint and tissue [illegible] tendency to stiffen if traumatized or immobilized and these make poor subjects for tendon repair. The presence of osteo-arthritis suggests this type. There are others who have not enough character to withstand the pain of moving their fingers after the tendon repair. With them an otherwise good result may be prevented. Before attempting a tendon repair, one must weigh well the gain of function to be expected with the amount of inconvenience and trouble to the patient.

After-treatment. The after-treatment is all important. It is best to avoid splinting the fingers, as too much immobilization allows adhesions to form. Instead, the wrist can be strongly flexed for a flexor tendon and held so by a check-rein of adhesive plaster running up and around the forearm. The muscles that pull the tendons are thus robbed of their power of too much traction and still they can keep the tendon actively moving. Motion should be encouraged from the first, but too much or too vigorous early motion causes hæmatoma and the opening of incisions. Later, a ball, a rounded match box, or a piece of rubber hose can be carried in the pocket and used for exercise in grasping. The restricting check-rein should not be removed for 5 weeks when union will be firm. Later the galvanic current may be used to contract the muscles sharply, thus snapping tiny adhesions. If the hand is soaked in hot water previous to exercising, it helps considerably. Actual hard work and the lapse of several months finally complete the loosening-up process. Co-operation by the patient is essential, and he must be willing to take some punishment in exchange for a good result.

It is well to give a guarded prognosis in these cases, but it is usually possible to restore from 80 to 95 per cent of lost function.

DEPARTMENT OF TECHNIQUE

POSTERIOR DISLOCATION OF THE FOOT WITH POSTERIOR MARGINAL FRACTURE OF THE TIBIA AND USUALLY WITH A POTT'S FRACTURE OF THE FIBULA[1]

By T. TURNER THOMAS, M.D., F.A.C.S., Philadelphia

TWENTY-FIVE years ago, as an interne, I had a patient with a posterior dislocation of the ankle in which the X-rays showed a posterior marginal fracture of the tibia. The records are not now available but my memory is clear as to the lesion and the difficulty in maintaining the reduction of the dislocation. I lost track of the case but the outcome must have been bad. Figure 1 represents a case concerning the history of which I know nothing, but it probably will answer for the final result in the above case. About five years ago I saw with Dr. Samuel Ellis, of Philadelphia, a woman with what I interpreted as the same condition but in which an X-ray was refused. As in the first case the reduction of the dislocation was comparatively easy, but it recurred as soon as the force was released. Having now what seemed a satisfactory conception of the condition, after reducing the dislocation I merely held the foot in forced flexion and applied a plaster cast. This was removed at the end of 8 weeks and the patient permitted to walk on the foot. Several years afterward Dr. Ellis reported that she had never complained of the foot afterward.

In the past three years I have seen and treated six similar cases and two others of what seems to me an equivalent condition in adolescence. In them the displacement occurred not at the ankle joint but at the lower epiphyseal line of the tibia with a posterior marginal fracture of the diaphysis. In one of these two there was associated a Pott's fracture, in the other not, but there was a Pott's fracture in five of the six dislocation cases. The X-ray illustrations presented here make a detailed report of each case unnecessary as they tell the essential parts of the story, i.e., the positions of the fragments before and after reduction. So far as the patients can judge, the results have been perfect in every case except two recent ones which promise as much as the others have attained, and in that illustrated in Figure 2, 7, in which early reduction was not permitted.

Stimson says of this condition: "I have never seen it in a fresh injury and do not know whether it could be recognized." I have assumed the presence of the posterior marginal fracture of the tibia whenever I found the posterior dislocation at the ankle joint, except in the first case seen in my interne days. In the second case it was assumed to be present but the X-ray was refused. In every other case the X-ray later showed this fracture to be present. In the third case, because the accident happened in the evening after the X-ray laboratories had been closed, the fracture was reduced and a cast applied before the X-ray was taken.

It has long been held that there is a decided tendency, in Pott's fracture, for the foot to slip backward, as one widely used textbook puts it, "sometimes so far that the body of the astragalus lies entirely behind the tibia; and this displacement is frequently overlooked." The Paris Surgical Society, in 1912, as the result of a paper read before it by Quénu, took such interest in this subject that nine of its meetings in that year were given up to its discussion. Quénu said that great physicians, such as Tillaux, have passed their lives insisting that the posterior dislocation of the foot was the result of a Dupuytren's fracture, and they have erred in recognizing only the essential lesions of this fracture, as the fractures of the internal malleolus and of the fibula. From cadaver experimentation, Quénu concluded that when all the essential lesions of a Dupuytren's fracture are present, a posterior dislocation of the foot cannot be produced. He also concluded that a posterior dislocation of the foot indicates the presence of a posterior marginal fracture of the tibia (such as is shown in the accompanying roentgenograms of my cases). Until the discovery of the X-ray it appears that the only authentic reported cases were those found postmortem (Earle, 1828–29; Malgaigne, 1832; and Adams, 1836). Grashey, in 1907, reported finding in 1500 roentgeno-

[1] Read before the Lackawanna County Medical Society, Scranton, Pennsylvania, September 20, 1921.

grams of all kinds of fractures, four "oblique fractures of the posterior tibial margin with posterior dislocation of the foot." Meissner, in 1908, reported a study of this condition based upon 19 cases. He had one case of isolated fracture of the posterior tibial margin, i.e., without posterior dislocation of the foot; 8 cases of the posterior marginal fracture of the tibia and posterior dislocation of the foot, with fracture of both malleoli; 1 case of the posterior marginal fracture and posterior dislocation, with fracture of the internal malleolus; 5 cases of the same fracture and dislocation with fracture of the fibula, and 4 cases with separation of the epiphysis.

Posterior dislocation of the foot may occur without a posterior marginal fracture of the tibia but seems to be very rare. Auvray reported a case before the Paris Surgical Society during these discussions, in 1912, and exhibited the X-rays of it. After examination of them by the members of the society there was manifested a difference of opinion as to whether they showed a posterior marginal fracture of the tibia or not. Quénu said that for one certain case and two disputable cases of posterior dislocation of the foot without a posterior marginal fracture, there was an abundance of roentgenographed cases of this posterior dislocation showing this fracture. Pels Leusden said that it was always present and Meissner that it was always or nearly always present.

What made these discussions by the French surgeons so warm and prolonged was that Quénu was attacking the long established view that the posterior dislocations were not the result of the Dupuytren or Pott's fracture but that the posterior marginal fracture of the tibia was practically always associated with and necessary to it. Although small, my experience offers a substantial corroboration of Quénu's view. Indeed, I assumed this etiology before I looked up any reference in the literature, conceived and applied my simple treatment and obtained good union and function in four cases before doing so.

For some years I have been interested in the mechanism of fractures and the cause of typical deformities, believing that a better knowledge of them would improve our methods of treatment, and in the *Annals of Surgery*, September, 1919, p. 359, I offered a paper on these phases of fractures and dislocations of the upper extremity. We have had ponderous works and much cadaver experimentation on the mechanism of fractures and dislocations, but with the exception of the dislocations of the hip we have made very little progress from them. The only worth while proof of the value of cadaver experimentation is in the

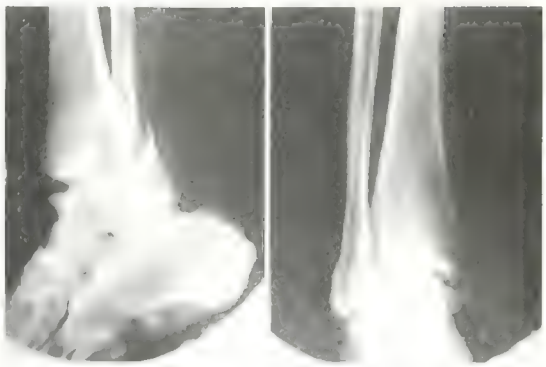


Fig. 1. [illegible] with posterior marginal fracture of the tibia [illegible] Lateral view. [illegible] the calf [illegible] backward [illegible] astragalus. A fracture of [illegible] the posterior lower [illegible]

improved results of the treatment based upon it. The results in the cases here reported and illustrated are offered as further proof of the ideas offered in the above mentioned paper. The fall is assumed to be the great cause of fractures and dislocations, but we cannot give direct proof of this because we cannot reproduce in the cadaver the ordinary fall of the living body nor the effect of the fall except in a few instances. In 1905[1] I reproduced fractures of the head of the radius repeatedly and a few Colles' fractures by the same mechanism as in the fall on the hand following von Bruns.[2] In my opinion, there are only two fractures in the body concerning the mechanism of which we talk with anything like confidence and unanimity: the Colles' and the Pott's fractures. We probably all agree that the usual Colles' fracture is due to the fall on the hand and that the usual Pott's fracture is due to eversion or inversion of the foot. At first thought, it might prove a little disturbing if anyone should ask if these mechanisms have been demonstrated by experimentation on the cadaver. Most of us would know little and care less about it. In my opinion, the proof is in the deformity. We have long ceased to attribute such deformities to muscle pull. The lateral deviation of the foot shown in Figure 2, 1, was obviously caused by a force driving the foot in that direction. It is equally obvious that the posterior marginal fracture of the tibia and the posterior dislocation of the foot shown here were due to a force driving the foot upward and backward. A clear history of such

[illegible]

Fig. 1.—The cases represented here by 1, 2, 3, 4, and 5, show in each instance, the lateral and anteroposterior views before and after the reduction of the displacements. In 6 we have both these views after reduction only, because none was taken before reduction. In 7 the patient refused to permit reduction and in 8 the anteroposterior views taken before and after reduction were lost.

a force was obtained only in connection with the case illustrated in Figure 2, 6. We must assume it for the others.

The best method of correcting the displacement is obviously to reverse the fracturing force as indicated by the position of the fragments and drag them back into their normal positions. It has so happened that in every one of these dislocations in which there has been associated a Pott's fracture of the fibula the general anæsthesia has had to be given a second time because, notwithstanding the effort made to correct both displacements in the first trial, the posterior displacement, although very much improved, was not completely reduced in any. During the reduction, first, traction on the foot was made with full strength, then the foot was carried forcibly into dorsal flexion and finally into abduction or adduction according to which was necessary to correct the lateral deviation of the foot. Overcorrection is not likely to occur, but undercorrection not infrequently happens. In Case 3 (Fig. 2,

6), in which there was no Pott's fracture, the first attempt was completely successful. For the second trial in the others, the cast applied in the first, was so cut away as to leave the upper portion down to the tips of the malleoli in order to preserve the correction of the Pott's fracture, and high enough anteriorly and posteriorly to permit the necessary dorsal flexion of the foot on the second trial which was sufficient in every case of pure dislocation-fracture. In the epiphyseal separation with dislocation-fracture (Fig. 2, 5), while the patient was under ether for the second trial at correction of the posterior displacement, an X-ray was taken and developed immediately after the first attempt at correction. This proving unsatisfactory, without permitting recovery from the anæsthetic, a second attempt and an X ray were made and as the result was still unsatisfactory a third correction and X-ray were made with the result shown here.

It will be seen on close examination of the roentgenograms that there is usually a posterior marginal fracture of the fibula also, even in Figure 2, 6, in which there is no Pott's fracture. In Figure 2, 1, the Pott's fracture is seen to involve the posterior marginal fracture of the fibula. Clearly the posterior marginal fractures are due to the same force as the dislocations and are essential to the dislocation, while the Pott's fracture must result from the lateral deviation of the foot. In Case 3 there was no Pott's fracture because the foot did not turn sidewise.

It has not been considered worth while to furnish individual histories of the different cases except the facts given in connection with the first two. Of others it seems sufficient to say that they all fell and all got perfectly well, except the last who has had the cast removed and when last seen had not yet recovered normal motion in the ankle, and the case illustrated in Figure 2, 7, who refused treatment. He was an excitable and apparently rather irresponsible young man who requested that he be transferred to another hospital than the one in which I first saw him. He was sent to another hospital but interference to be admitted there [illegible] ago and I was told recently by a neighbor that he had since been operated on twice by another surgeon and that he could now walk. Rowlands[1] illustrates two cases by X-ray and one of them by photographs taken before and after operation. In this case before operation "the limb was almost useless." The operation consisted of a tenotomy of the tendo Achillis with osteotomy of the tibia and fibula through a small incision 1 inch above the tip of the internal malleolus. The function of the limb later was good, the patient being able to walk long distances without pain and move the ankle well.

[illegible]

1. Posterior dislocation of the ankle with fracture of the posterior tibial margin and Pott's fracture has received little attention in this country. The dislocation has been generally attributed to relaxation of the ankle joint resulting from the Pott's fracture.

2. The prognosis will depend largely upon the degree to which the reduction of the displacements has been accomplished and maintained during the development of bony union. Without reduction the impairment of function must be serious. With reduction the function has been essentially normal in all of my reduced cases except in two recent ones which have not yet had sufficient time to recover normal function.

3. The reduction should always be proven by the X-ray, and it should be maintained by a plaster cast because no other method will maintain the reduction satisfactorily. Moreover, for the same reason, the cast should not be removed until bony union is assured.

1. [illegible]

A SELF RETAINING, EASILY REMOVABLE DRAINAGE TUBE

BY MAX BALLIN, M.D., F.A.C.S., DETROIT, MICHIGAN

EVERY surgeon knows the difficulties encountered after certain operations in keeping drainage tubes in place. I refer to drainage following operations upon the gall bladder, draining the urinary bladder, drainage of deep axillary wounds after breast operations, etc. The generally adopted method is to fasten the tube in the depths of the wound by means of a loose catgut suture, then either forcibly tear this suture when removing the tube or wait for absorption of the catgut. The first procedure is painful and the second cannot always be accomplished at the time desired, because catgut is not absorbed uniformly. On the other hand, if the tube is not fastened at all, it may easily slip when making the final toilet—removing the pads or suturing the wall. Such a loose and unfastened tube frequently does not perform its function for the reason that the end does not remain in its proper place.

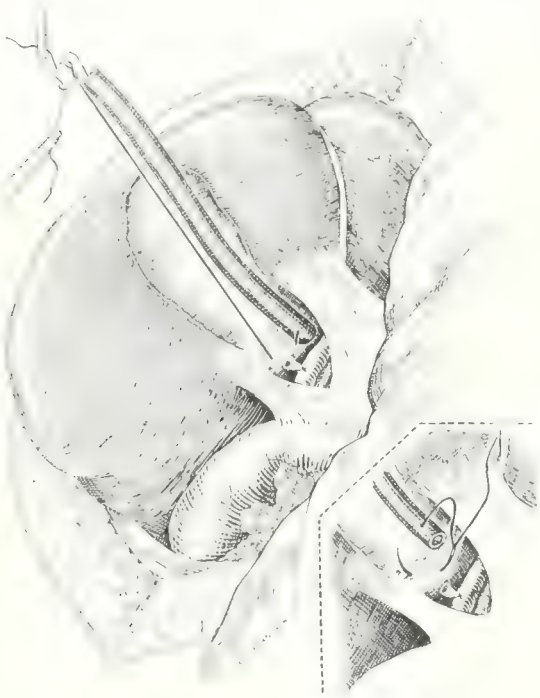


Fig. 1. Drainage tube fastened close to stump of cystic duct after cholecystectomy. The suture, passed through the tube, is fastened close to the stump of the cystic duct as shown in the insert, then tied over the end of the tube, outside the abdomen, without bending the tube.

We have overcome this difficulty (perhaps others have used the same simple procedure) in the following manner: A long black linen thread is drawn through the lumen of the tube, passed through a needle and stitched through the side of the tube close to its end. A stitch is then taken in the depth, fastening this end of the tube to the tissues close to the point where drainage is to be expected (Fig. 1). The thread is then brought out of the wound and tied over the exposed end of the tube. In this way the pads can be easily removed without dislodging the tube.

When it is desired to remove the tube, the thread outside the tube is cut. To preserve asepsis, this is done just beneath the skin after applying a drop of iodine. The tube is then easily withdrawn, the thread being pulled from the tissues without causing any injury or pain.

We have found this tube very practical because of the painlessness of its removal. It can be used wherever retention of drainage tubes in their proper place is difficult. In cholecystostomy we suture the tube to the incision in the gall bladder, tightening the gall bladder about it with a purse-string which does not perforate the tube. In cholecystectomy, as illustrated, the tube is fastened close to the stump of the cystic duct. In prostatectomy we suture the tube to the incision in the bladder, tightening the vesical walls around the tube by a few sutures. In breast amputations we fasten the tube to the stump of the pectoralis muscles.

THE UTILIZATION OF THE PECTINEUS FASCIA IN CERTAIN FORMS OF INGUINAL HERNIA

BY WALTER D. WISE, M.D., F.A.C.S., [illegible]

WHILE in some noted clinics, the step of cord transplantation in the repair of herniæ has been abandoned, we have felt more convinced each year that in the majority of cases it is a good procedure. We do not use it in children or in young adults with indirect herniæ, who have well-developed and well

This is done with a figure-of-eight or double row of interrupted sutures and the edge of Poupart's ligament brought up and sutured to the [illegible] oblique with interrupted sutures as described in several recent articles on the subject. The cord is placed between the external oblique and the subcutaneous tissues. In this way, of course,

Fig. 1. Showing a figure of eight suture [illegible] through the pectineus fascia.

arranged muscles with a thin-walled, narrow sac. It is used in all direct herniæ regardless of the size of the sac; in all recurrent herniæ and practically all patients over 25 years of age suffering with the indirect variety. Formerly it was not done when using a local anæsthetic, but lately the cord has been transplanted in these cases also. After the adoption of the plan outlined, our recurrences were fewer than with the cord left in its bed, but we still had an occasional recurrence, particularly in patients over 30 years of age who had been operated upon for direct hernia. Three years ago, following the lead of A. C. Harrison, we began to use the imbrication method of carrying the edge of the external oblique down to Poupart's ligament along with the internal oblique and conjoined tendon

the inguinal canal is closed completely at its medial end. Usually this method of closure makes a most satisfactory repair. We have not attempted to trace our cases, but in the 3 years since its adoption, no instance of recurrence has come to our attention (with the exception of one in which in some manner the, or a, sac was overlooked). The series contains many cases of recurrence after operations by other methods and one of double recurrence after a Bassini operation for double direct hernia, considered inoperable, but operated upon in each instance at the insistence of the patient. In the case there was as great a dearth of structures as is likely to be seen, as the patient was [illegible] years of age. One side has been operated upon by this method [illegible] the other [illegible]

with no sign at this date, of any weakness in the inguinal regions. All the operations were done by the writer. While we feel that this is, to us, the most pleasing operation so far used and the results satisfactory, yet no possible chance of improving a hernia repair should be neglected. It is this feeling that prompts the suggestion of a modification which is useful in some cases.

While it is remembered that the medial end of Poupart's ligament is re-enforced by Gimbernat's ligament and is, in most instances, strong enough to meet the demands of any hernia operation, nevertheless, it is in some patients weak, frayed, or so thin that it does not seem equal to the responsibility placed upon it. Of course all structures in the repair of a hernia should come together without tension, but this is not always entirely feasible and in the recovery from the anæsthetic and during convalescence there are apt to be periods of strain in which an inferior quality of Poupart's ligament might not hold. In this class of cases, it is our custom to start the figure of eight suture in the pectineus fascia and muscle, passing it through Poupart's ligament, catching the conjoined tendon and then the shelving edge of Poupart's ligament, back for the edge of the external oblique, thence through Poupart's ligament again to pick up the pectineus fascia and muscle. It does not change the usual relationship of the structures, but the inclusion of the pectineus fascia and muscle with Poupart's ligament gives a much greater sense of security for the one or two sutures thus placed. In addition to this, it at the same time closes the femoral canal as is done in the repair of a femoral hernia. If it is true that the repair of an inguinal hernia tends in a certain number of cases to the production of a femoral hernia, then these sutures materially lessen this tendency. Obviously the placing of these sutures is limited laterally by the femoral vein, from which point the usual manner of placing sutures is followed.

THE USE OF THE ELECTRIC CAUTERY IN LARYNGEAL TUBERCULOSIS[1]

By GEORGE B. WOOD, M.D., PHILADELPHIA

THERE are few morbid conditions that cause more distress and pain in the final agonies of life than does advanced laryngeal tuberculosis, and there is scarcely another condition in which the physician feels more hopeless not only in his efforts to prolong life but also in his endeavors to alleviate suffering. There was a time when almost every case of laryngeal tuberculosis, incipient or otherwise, held for the afflicted patient a future to which even his physician could look forward with only dread and misgiving. Of recent years, however, a gradually growing confidence has replaced the pessimism of yesterday, so that today the laryngologist is not necessarily touched by panic when an incipient case of tuberculous involvement of the larynx is first diagnosed. For this, he has to thank not only the modern treatment of general tuberculosis, and we must recognize its efficiency, but also the improvements in local therapy. The local treatment has two purposes: one palliative, applicable especially to advanced and hopeless cases, and the other curative. Both of these, however, overlap in their application. Palliative measures will, at times, permit the swallowing of more food with a consequent improvement in the nutrition of the patient, while, on the other hand, the curative methods are frequently, and almost at the moment of their adoption, attended with distinct lessening of the pain and soreness. In this paper, I am dealing only with the question of curing laryngeal tuberculosis. In my experience, the application of medicine, such as lactic acid, formaline, and other germicides has little effect upon the progress of the tuberculous disease, though their use is frequently indicated to combat secondary infections. The real curative measures belong to the domain of surgery. Bloody surgery of the tuberculous larynx, though frequently accompanied by very favorable results, has reached the end of its usefulness for the sole reason that the electric cautery will in almost every instance accomplish the same results, with none of its disadvantages, and it does exceeding more than could ever be hoped for from other surgical procedures. It is undoubtedly the method *par excellence*, and its use brings to the surgeon that peculiar sense of elation which he feels when, through his interference, suffering and death have been averted.

Clinically, laryngeal tuberculosis assumes various forms due to the anatomy of the part involved, to the resistance of the individual, to the presence of secondary infections, and to other modifying circumstances, but the disease itself is essentially a cellular infiltration with the formation of tubercles. This infiltration is avascular so that the cells in the center of the enlarging tubercle lacking nutrition rapidly degenerate under the action of the tuberculous toxins giving rise to the characteristic caseation. If it were possible to revascularize this tissue, a big step would undoubtedly be taken toward the cure of the lesion. Bier recognized this fact when he introduced his method of inducing hyperæmia. I believe that the beneficial action of the cautery is due more to the revitalization of the tissues than to the destructive action of the heat.

In 1910, I removed with a cautery snare, for diagnostic purposes, a portion of a suspicious tonsil from an arrested case of pulmonary tuberculosis. The portion of the tonsil removed showed extensive typical tonsillar tuberculosis. Five days later, I removed another portion of this tonsil, including the scar made by the previous cauterization. In this scar, there was already a well-developed fibrous tissue, changing the histological picture so that now only a single tubercle was found after the examination of numerous sections and this small tubercle was being rapidly converted into fibrous tissue. This finding led to a series of experiments on guinea pigs. After experimenting with tubercle bacilli of various degrees of pathogenicity, I was finally able to produce localized cutaneous lesions of the abdomen. Some of these lesions I partially excised, as controls, and others I cauterized, not destroying them completely, but only making a fairly deep puncture cut through the center with the electric knife. The tubercles, partially excised, developed without any evidence or even retardation, while those cauterized invariably disappeared. By killing the pigs at various stages, a histological study was made of the healing process.

In 3 days after the cauterization, there developed a distinct zone of inflammatory reaction around the area of destruction. This reaction was manifest by the presence of newly formed blood vessels, congestion, and fibroblasts. In 6 days, the zone of reaction was much more marked, and the blood vessels were larger and more numerous. Also, there was a distinct deposit of fibrous tissue between the epithelioid cells of the tuberculous mass. At this time, the tuberculous process beyond the zone of reaction was apparently unaltered, except that it seemed to be decreasing in size. In 20 days, a complete fibrous cicatrix had formed throughout the zone of the inflammatory reaction, and, though there was still some evidence of the tuberculous disease on the tissue beneath the scar, the epithelioid cells were being rapidly replaced by fibrous tissue throughout the entire tuberculous area. To summarize: An eschar formed by the cauterization is sloughed off by the formation of granulation tissue. The development of the granulation tissue is attended by the formation of new blood vessels which grow through a previously avascular area. This brings nutrition to the fixed connective-tissue elements, enabling them to withstand the action of the tubercle toxin, and it is also possible that the epithelioid cells themselves, because of the added nutrition, develop into fibroblasts. The object, then, of our cauterization of a tuberculous larynx is not so much a destruction as it is a healing of the tubercle, and the great advantage to the patient that the cautery has over bloody surgery is that important organs are not removed or destroyed except by the disease itself. At the present time, I believe that all the various clinical types of localized tuberculous lesions, be they infiltrative, ulcerative, or of the tumor type, if they are within reach will be more successfully combatted by the cautery than by any other form of treatment, no matter in what part of the throat or larynx they occur.

TECHNIQUE

The object of the cauterization is, as has been stated, the production of an eschar rather than destruction of all the tuberculous tissue, and this fact makes the procedure a comparatively minor affair. The application of the cautery may be done either by direct or indirect laryngoscopy. There are a number of laryngologists who prefer the direct method and some who even use suspension laryngoscopy. In certain cases, the direct method can be used with advantage, but the ease with which the cauterization of the larynx can usually be accomplished by the indirect method makes this method the one of choice in the majority of cases. Of course, the laryngologist must be trained to the intralaryngeal manipulation of instruments.

Concerning the equipment, it is important that the supply of electricity, whether from battery or from a street current controlled by a rheostat, is of sufficient strength to heat the cautery knives to a white heat almost instantaneously. Also, the platinum point of the knife should be shorter than the usual pattern in order to prevent burning

edematous process which is apt to occur from spasmodic closure of the larynx. Three types of knives are necessary. A sharp, pointed one for puncture; a large, flat knife for searing ulceration, and a small, wire loop for treating small infiltrations.

Cauterization of the larynx should always be done under local anæsthesia. I prefer the following method: 1 grain of powdered cocaine is placed in sterile glass and a cotton applicator soaked with sterile water is dipped in the powder. This application is carried into the larynx as far as possible, though on the first trial in many cases the patient's reflexes will prevent the swab being introduced below the ventricular bands. After waiting 3 minutes, a second application is made, using more of the original grain of cocaine, and it will be found at this time that the swab can be carried directly to the area to be cauterized. After waiting another 3 minutes, we can generally proceed with the cauterization. However, sometimes a third application is necessary. The swabbing has, in my hands, been much more efficacious in producing anæsthesia than the instillation of cocaine with the syringe.

Experience alone enables the operator to judge best the amount and character of the burn which he should make in each individual case. As a guiding rule, infiltration and swelling require ignipuncture, while ulcerations should be seared with a broad knife. Tuberculomata, especially those occurring in the interarytenoid space, must be more or less completely destroyed and here, again, the larger knife is necessary.

When the epiglottis is involved without ulceration, a series of punctures should be made into the swelling, perhaps one-eighth to one-quarter of an inch apart. In making these punctures, a sharp-pointed, short knife while still cold is plunged into the tissue, and then the current turned on for a moment until there is a surrounding areola of white eschar. If there is ulceration, the exposed tissue should be seared with a flat, broad knife. Formerly, and even today by some laryngologists, a badly diseased tuberculous epiglottis calls for immediate removal. I believe, however, that better results can now be obtained with the cautery in almost every instance, though freedom from pain may not be quite as quickly obtained. The very grave risk of a dissemination of tubercle bacilli, however, is avoided and we are able to preserve as much of the epiglottis as has not been absolutely destroyed by ulceration.

The use of the puncture for infiltration and the broad knife for ulcerations applies to other portions of the upper larynx besides the epiglottis. In the pyriform swellings of the arytenoid, which are so common in laryngeal tuberculosis, ignipuncture is remarkably efficient, and the rapid reduction in the swelling is astonishing. Below the level of the arytenoids, however, ignipuncture should not be used except perhaps in cases attended with marked swelling of the ventricular bands and the walls of the larynx just above them. Infiltrative growths below this level, interfering with the functioning of the chords, are usually so intimately connected with these important structures that great care must be exercised in their reduction. The amount of destruction can be more accurately gauged, if the tissue is attacked from the surface than from a puncture of indeterminate depth. In this region, an attempt should be made to remove the exuberant tissue down to the level of the normal structures, and not deeper unless the disease process has already destroyed their contour. When the ventrical of Morgagni is involved, as it frequently is, a broad knife bent sideways should be introduced just below the edge of the false chord. The large tuberculomata which occur in the inner arytenoid region are most efficiently attacked by a broad, large knife. A small wire loop makes the best type of knife for dealing with small tuberculomata on the vocal chords or vocal processes

I have never seen any very violent reaction following the use of the cautery in the larynx, such as might threaten closure of the larynx from œdema, and usually the resulting soreness is only enough to cause a slight discomfort for the first 24 or 48 hours. In two cases, complete aphonia followed cauterization of the vocal chords; one lasting only for 2 days and the other for an unknown length of time, as the patient passed out of my hands soon after this happened. I cannot recall, at the present writing, any other untoward result, great or small, following the use of the cautery in the larynx.

The repetition of the cauterization should not be undertaken until the previous one has healed, unless an entirely new area of the larynx needs to be treated. Then a second cauterization may take place within a few days as soon as danger of any reaction has passed. The benefit to be expected from a cauterization cannot be fully determined until probably 3 or 4 weeks have elapsed, during which time the slow process of cicatrization is going on. On the other hand, it is not uncommon to see the tuberculous ulcer covered with normal epithelium within a week or 10 days following the cauterization.

There are, of course, therapeutic measures necessary to a successful handling of laryngeal

tuberculosis, other than the use of the cautery, as the local lesion, in the vast majority of cases, is associated with pulmonary disease. It is essential that appropriate general treatment be adopted for the control of the pulmonary condition and this general treatment is an important aid to the local therapy. In many of these cases, however, the cure of the laryngeal condition is so important that sometimes the general therapy has to be modified so that the patient may be in the hands of a competent specialist. Also as to local measures, we must recognize the importance of vocal rest, the application of various medicines for the control of secondary infections, and the relief of pain. Untreated laryngeal tuberculosis usually follows in its course the progress of the pulmonary condition, although frequently it becomes the predominating lesion, developing much more rapidly than the disease in the lungs. On the other hand, I have frequently seen laryngeal lesions heal under the application of the cautery while the pulmonary condition was growing progressively worse. I am so enthusiastic about the use of the cautery in this disease that I believe that 90 per cent of incipient cases can be cured and that the benefit obtainable is only limited by our ability to reach all of the [illegible] has enough vitality to produce the [illegible] reaction for the healing of the burned area.

Cauterization with the electric knife is [illegible] new method of treating laryngeal tuberculosis, nor in bringing this subject to your attention at this time am I offering any particular technique, but I am [illegible] universal [illegible] efficiency in treating this disease. A sanitarium for the treatment of tuberculosis unequipped [illegible] proper place for these patients to be taken care of and the laryngologist who fails to make use of its therapeutic perfection is also not prepared to handle these cases.

SQUAMOUS-CELL EPITHELIOMA OF THE LIP

Its Surgical Indications

By JOHN HUNT SHEPHARD, M.D. [illegible]

In 1910 A. C. Broders[1] demonstrated that it is possible to classify squamous-cell epitheliomata, according to their degree of malignancy, into four grades or groups.

Prior to his work pathologists seemed content to report a given lesion of the lip as being "benign" or "malignant." Occasionally one would venture the statement that a certain growth was "highly malignant," basing his opinion upon the degree of cellular activity as manifested by the invasion of the adjacent musculature by the cancer cells. It has been only a few years since medical schools taught that the presence of pearly bodies is essential before making a diagnosis of squamous-cell epithelioma. While approximately 98 per cent of all squamous-cell epitheliomata do show pearly bodies, their presence is not essential; they result from the process of differentiation.

For years it has been known that some lip cancers are fatal while others are not. Most surgeons have had the experience of telling a patient with lip cancer that his only hope for a cure depends upon a radical surgical operation, only later to be embarrassed by learning that his former patient had been cured by some paste, plaster, or other form of non-operative treatment.

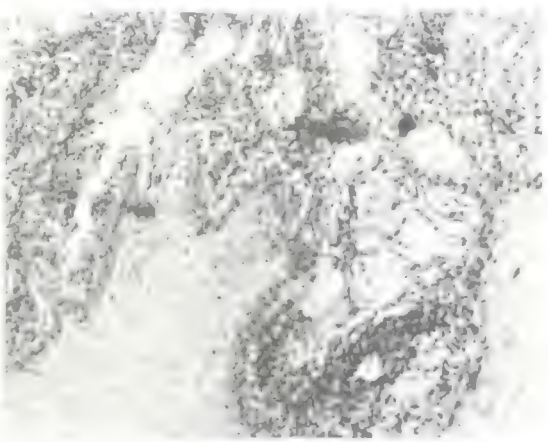


Fig. 1. Squamous-cell epithelioma of the lip, grade 1. [illegible] infiltration.

[illegible] A. C. J. M. A.

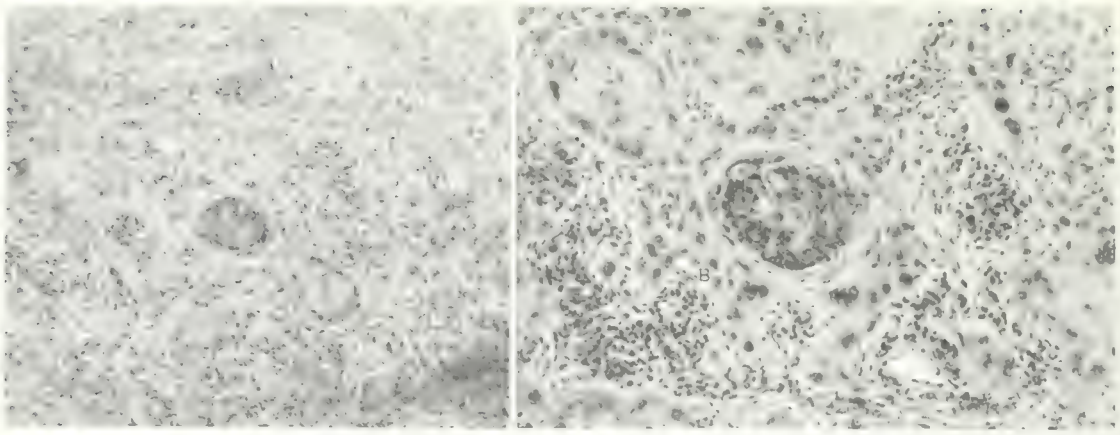


Fig. 4. [illegible] Squamous-cell epithelioma of the lip. [illegible] Differentiated and undifferentiated tissue about equal.

Fig. 5. Squamous-cell epithelioma of the lip, grade 2. A. "One eyed cell." Differentiated and undifferentiated tissue about equal.

The indications for operation of lip cancer have, in the past, been based upon clinical judgment and individual experience. Surgeons have had no common ground upon which to compare their operative results. Some have advocated a complete dissection of the submental and submaxillary triangles in every case; others advising such dissection only in those cases presenting palpable glands in the triangles; others limiting their operative work to the immediate vicinity of the growth while the most radical have advised a complete block dissection of the entire side of the neck corresponding to the side of the original growth together with the removal of all gland-bearing tissue from the opposite submental and submaxillary triangles.

Broders found that the growths comprising his four grades or groups possess a definite and different killing power. "Among the known causes of death, deaths from epithelioma were as follows: none in grade one; 54.9 per cent in grade two; 84.21 per cent in grade three, and 100 per cent in grade four." These results were irrespective of the type or extent of treatment. He also found that all patients showing metastasis in the cervical lymph nodes or in any two or more groups of lymph nodes, at the time of operation, had died and that of the patients reported dead who had shown metastasis over 90 per cent had died from epithelioma.

We note that those cancers of the lip which fall in grade one and which comprised 15.82 per cent of Broders' series of 537 patients, have no killing power, and, therefore, should be given conservative treatment, while those falling in grade four have a killing power of 100 per cent, and therefore it is useless to subject these unfortunate patients to a major operation.

On account of the nature of the original growth, it presenting an exposed ulcerating surface, more or less infection is present in a large percentage of the cases. Although this infection is usually mild, it frequently gives rise to inflammatory enlargement of the lymph glands draining the involved area. By palpatory examination it is often impossible to differentiate between this inflammatory enlargement and glandular metastasis. For this reason it is often necessary to start a glandular dissection and await the pathologist's report before deciding how extensive an operation to perform.

Since we are now able to grade these growths according to their degree of malignancy, it is possible to formulate certain rules for our guidance of their treatment. In the future we will be able to compare results from an intelligent, definite viewpoint and useless radical operations should be few and fatal conservative treatment rare.

Grade 1 (comprises 15.82 per cent). Complete removal of the cancerous area. Depending upon the size and location of the growth this may be best accomplished with the least disfigurement by the X-ray or radium in one case, a V excision in another, or a plastic operation in a third case.

Grade 2 and Grade 3 (comprising 83.05 per cent). A. When no glandular metastasis is present: Complete removal of the cancerous area together with a complete removal of all gland-bearing tissue from the submaxillary and submental triangles of both sides of the neck.

B. When glandular metastasis is present: 1. When the cervical glands are not involved

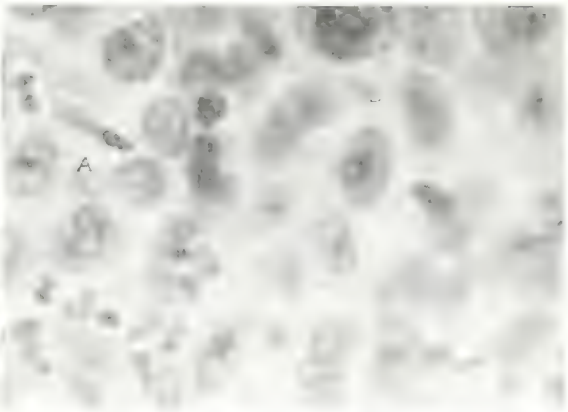


Fig. 4 at left. Squamous-cell epithelioma of the lip, grade 4. *a*, Mitotic figure. *b*, "One-eyed cells." No differentiation present.

and only one group of the submental and submaxillary glands is involved: Complete removal of the cancerous area together with the removal of all gland-bearing tissue from both submental and submaxillary triangles and the removal of the upper superficial and deep cervical glands of that side of the neck corresponding to the metastatic growth.

2. When two or more groups of glands or when the cervical glands are involved: Complete removal of the cancerous area together with a complete block dissection of that side of the neck corresponding to the involved area, sacrificing the sternomastoid and omohyoid muscles and the spinal accessary nerve, and a dissection of the submental and submaxillary triangles of the opposite side.

Although such radical surgery will often prolong life a five-year cure is not to be expected in these cases.

Grade 4 (*comprising 1.11 per cent*). Palliative treatment. The classification of squamous-cell epithelioma into the four groups representating the various grades or degrees of malignancy is accomplished from the study of microscopic sections of the growth. It is based primarily on the degree of differentiation present although the presence of mitotic figures and "one-eyed cells," i.e. cells with large deep staining nucleoli, is to be taken into consideration. On account of the characteristics of adult squamous-cell tissue, differentiation toward the adult type is more easily recognized than in other kinds of tissue. While it is quite probable that other forms of cancer possess definite cellular characteristics corresponding to their degree of malignancy such characteristics have not been established.

If a squamous-cell epithelioma shows three-fourths of its tissue to be in a high state of differentiation with no mitotic figures and no "one-eyed cells" present, it is classed as Grade 1.

When approximately one-half of the tissue is differentiated and only an occasional mitotic figure and few "one-eyed cells" are present, it is classed as Grade 2.

When only one-fourth of the tissue is differentiated and mitotic figures are seen in every field or third field and two or more "one-eyed cells" are present in practically every field, it is classed as Grade 3.

When no differentiation is present and mitotic figures and "one-eyed cells" are freely distributed throughout the specimen, it is classed as Grade 4.

While it is easy to distinguish a Grade 1 from a Grade 4, it requires considerable experience to classify properly many of the growths which are on the border line between any two grades. However, it is surprising how seldom disagreement occurs between two persons familiar with the work and the frequency of squamous-cell epithelioma affords ample opportunity for any pathologist to familiarize himself with it.

CONCLUSIONS

1. Squamous-cell epitheliomata vary in their degree of malignancy.

2. On account of this variation in malignancy "cancer cures" do cure a certain percentage of the cases.

3. It is practical to grade squamous-cell epithelioma according to their degree of malignancy.

4. Rational treatment of squamous-cell epithelioma depends upon a proper grading as to their degree of malignancy.

CHOLECYSTOSTOMY OR CHOLECYSTECTOMY—WHICH?[1]

By MILES F. PORTER, M.D., F.A.C.S., Fort Wayne, Indiana

IS the question "Cholecystostomy or cholecystectomy—which?" a pertinent one? Has the gall bladder a function or functions to perform that are of importance to the economy or is it a practically useless and more or less troublesome appendage to be treated by the surgeon as is the vermiform appendix? Upon the answer to this question should depend in large measure the surgeon's treatment of the gall bladder. In a former paper (1) the writer presented evidence which seemed to establish the fact that the gall bladder in man was an important though not vital organ.

Rous and McMaster (2) in experiments on animals proved that the "concentrating activity" of the gall bladder was a function indicating that it was an organ of "special importance to the organism."

Robson (3) recently emphasizes the importance of the reservoir action of the gall bladder and says that "sufficient time has not yet elapsed to show whether the liver is injuriously affected by this pressure (after cholecystectomy) and absorption. . . . Whether cirrhosis of the liver and pancreas will result in a certain number of cases remains to be seen."

Rous and Larimore (4) found that both monolobular and diffuse intralobular cirrhosis were produced by ligation of the common duct.

Flexner's experiments prove that when pure bile is injected into the pancreatic ducts it produces pancreatitis, but when the bile is mixed with mucus before injection it is harmless.

R. C. Fravel (5) reports a series of cases of cholecystitis with and without stones, in a large percentage of which there was hypochlorhydria. He says "whether the gall bladder has a function or not the effect of its removal must be decided before we can dogmatically say that all diseased gall bladders should be removed." This author also refers to Holweg's (6) observation of 42 cholecystectomized patients suffering from gastric symptoms, in 83.3 per cent of whom hydrochloric acid deficiency was found, and his statement that a similar phenomenon followed cholecystectomy in dogs. He suggests that the acid produced in the stomach may be an index of the function of the gall bladder and advises against the removal of the gall bladder in those cases in which, from the acid content of the stomach, it seems capable of functioning.

It is contended by some that the value of a functioning gall bladder to the economy is not great enough to warrant the leaving of those even possibly dangerous. Says one: The "recurrence of gastric symptoms after cholecystostomy usually means that the gall bladder should have been removed." My own opinion and experience is not in accord with this. On the contrary my experience has been that continuation of symptoms after cholecystostomy means in the majority of instances either (a) overlooked or new-formed stones, (b) cholangeitis, (c) ulcer of the stomach or duodenum, or (d) pancreatitis. Now and again one finds in the literature a case wherein symptoms attributed to gall-bladder disease were found to be the result of a diseased appendix; however, the more frequent error consists in accusing the appendix when the gall bladder is the real culprit. The deductions made by many of those who champion the cause of cholecystectomy as against cholecystostomy are frequently fallacious. One finds many cases reported purporting to prove that cholecystectomy frequently relieves cases wherein cholecystostomy fails. In the majority of these reports a careful analysis of the individual cases will show that when the cholecystectomy was done a stone or stones were also removed. Jacobson (7) in his paper on the gall-bladder work done at the Peter Bent Brigham reports five secondary operations for overlooked stones. In four of these cases the primary operation was a cholecystectomy. In Jacobson's series (397) of cases "a normal gall bladder was removed in sixteen." Five of seven of these patients who were traced reported that they were "unimproved or in worse condition than before the operation." This report of Jacobson's illustrates the dangers of an overweening faith in cholecystectomy consequent upon an unwarranted suspicion of the gall bladder as a power for evil and an equally unwarranted belief in its uselessness. In a clinic manned by men believing that the gall bladder is an important organ, the bellies of these patients would have been closed perhaps after providing for drainage of the gall bladder, and the search for the real trouble continued at once on development of the fact that neither the gall bladder nor bile showed any pathology. This report seems to me also rather to prove the danger of routine operations in general and to emphasize

[1] Read before the Western Surgical Association, St. Louis, December [illegible].

the force of Eastman's statement (8) that "it is mischievous to take out the gall bladder simply because it is an attractive operative procedure. If we had to deal with an infection of the gall bladder alone, this would be a very easy question to solve: but I have never seen a badly infected gall bladder that was not associated with infection of the ducts, or with infection of the pancreas. I believe we shall decide more and more to utilize the gall bladder for drainage in such cases" than to lead to the conclusion the writer reaches, viz., that "cholecystectomy is the operation of choice in cholelithiasis and cholecystitis whenever feasible." Evidence is rapidly accumulating which seems to show that infection of the gall tracts usually commences in the liver (9). This evidence minimizes the force of the argument that removal of the gall bladder is an important factor in the cure of cholangeitis and its results, and emphasizes the value of drainage. I am firmly convinced in my own mind that the cures which have followed cholecystectomy in cases wherein cholecystostomy failed, except those wherein additional stones were found, are to be explained many times on the basis of the drainage consequent upon the cholecystectomy with its resultant dilatation of the common duct and paralysis of the sphincter of Oddi, and not to the fact that a nidus of infection (i.e. the gall bladder) was removed, or to the fact that the "only serious contractile force in the biliary system has been cut out," as held by Archibald (10). Another argument advanced in favor of removal of the gall bladder is that a diseased gall bladder after drainage probably does not regain its power to function normally. This argument is refuted by the fact that numerous gall bladders have been examined after cholecystostomy and found normal, while there are recorded many hundreds of patients entirely free from gall-bladder symptoms following this operation. Personally I never knew an acute cholecystitis that failed of a cure from cholecystostomy, unless a stone had been overlooked, save one. This exceptional case was one of acute cholecystitis and cholangeitis with jaundice. The drainage was not kept up as long as it should have been, soon after it stopped there was an acute return of symptoms including jaundice, a second operation was refused, death ensued and at autopsy the common and hepatic ducts were found to contain pus and masses of grayish inspissated mucus.

W. J. Mayo (11) says: "A seriously infected gall bladder cannot exist without evidence of infection in the glands which drain it," and in such cases as fail to show the ordinary signs of infection "the mucosa will if examined show

Now and again a typical gall-bladder stone will be the only physical finding lending color to the clinical picture of chronic cholecystitis. Yet again even this positive evidence may be absent and we have left only the appearance of the mucosa and the divided walls of the gall bladder to depend upon. Supposing all these signs fail, shall we remove a gall bladder on the clinical symptoms alone? It is not denied that a gall bladder may be infected to a degree requiring [illegible] senses, but I have never had such a case demonstrated to me. And I have [illegible] drain such gall bladders rather than remove them.

Routine removal of the gall bladder is based upon the following [illegible]

1. That the gall bladder is an unimportant organ and that its removal is followed by no untoward results.

2. That all gall stones have their origin in a "primary cholecystitis" (12) and that recurrence or continuation of symptoms following cholecystostomy is usually due to the fact that the gall bladder was not removed. The facts are:

1. We [illegible] tion that the gall bladder is an important organ and evidence is not yet at hand to warrant the conclusion that its removal leads to no serious consequences.

2. Cholecystic disease including gall stones frequently if not usually originates in the liver. Routine cholecystectomy frequently fails to cure and leads to the removal of healthy gall bladders in over 4 per cent of cases.

The gall bladder should not be removed unless it has become useless or dangerous by disease.

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EDITORIALS

SURGERY, GYNECOLOGY AND OBSTETRICS

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ALLEN B. KANAVEL, M.D. — Associate Editor

JULY, 1922

ON THE USE OF TRANSDERMIC APPLIANCES IN THE TREATMENT OF FRACTURES

WHETHER right or wrong, when an idea has once gained credence among surgeons it has a tendency to stick. This conservatism is good in so far as it prevents the too easy acceptance of half-baked theories; but it is unfortunate when it inhibits the introduction of new and valuable procedures, as it sometimes does.

For instance, our notions regarding the vulnerability of the peritoneum kept us for a long time out of the abdominal cavity, and our conviction that it was dangerous to irrigate the surface of the pleura prevented us from employing antiseptic solutions in the treatment of empyema.

Similarly, the fear of infection in fractures of the long bones has caused us to shy at the adoption of various useful methods of fixation, traction, and extension, which have been presented from time to time, such as the external bone-clamp, the wire-and-nail traction of Steinmann, the ice-tongs of Ransohoff, and the fixation of fragments by means of nails and screws inserted through the skin.

But in the face of this deeply rooted prejudice, an extensive experience in the Great War, added to that of civil practice, as reported by many observers, has demonstrated that when properly carried out the likelihood of infection in these procedures is slight and our fears have little justification.

In fact, from the evidence now at hand, it seems fair to assume that if the skin is well prepared there may be introduced through it into the bone, and left there almost indefinitely, screws, nails, wires, or ice-tongs, as indicated, with almost no danger of infection, provided these things are clean and that they fit the openings snugly without undue pressure or traction upon the surrounding integument, safety being doubly assured by means of a dry dressing and the occasional application of weak tincture of iodine.

When this principle is widely recognized, as it should be, it will open the way for a more simple and effective treatment of certain fractures in which the results leave much to be desired at the present time. Few surgeons will venture to deny, for instance, that traction by means of tongs or wires applied directly to the bone may be more effective and practicable than that obtained by strips of adhesive plaster attached to the skin; and, in addition to conserving motion of the adjacent joints, the method may be employed where the condition of the skin prevents the use of splints or adhesive. Likewise, the external bone clamp, the principles of which have been so well described by Parkhill, offers many advantages in the way of fixation and extension, in fractures of the more superficial

long bones, if only we were not afraid to use it. For instance,—the ease of application and removal (it sometimes may be inserted through mere punctures in the skin); the safety of placing the screws far from the line of fracture; the fact that the instrument is mostly external and not internal, like a Lane plate; and the firmness with which the fragments are held, because of the stability of the clamp and the size of the removable bone-screws.

From experience with the external bone clamp and traction by means of wires, nails, and tongs, the question of infection resolves itself into this: If proper cleanliness is observed, the danger is slight and distinctly less than in the use of an internal plate; because a minimum of manipulation is required and the line of fracture is not encroached upon by a foreign body. But if the operation is not clean, suppuration will supervene, as in any other surgical procedure, although the results are apt to be less disastrous because of drainage afforded by the openings through the skin. In addition, the screws can be removed at any time, thus eliminating all disturbing material. Unfortunately for a correct understanding of the situation, it often is more agreeable to attribute a septic disaster to something inserted through the skin than to an error in technique, although the comparative frequency of infections in connection with other operative procedures, such as the use of the Lane plate, should assist us in avoiding such misconceptions.

The notion that a late infection is apt to creep into the bone along screws, nails, or wires is largely theoretical as has been demonstrated regarding the external clamp and the Steinmann traction; and if such an infection should occur it is almost invariably trivial, being localized by the formation of an enveloping granulating channel.

In conclusion, whatever may be one's opinion regarding the [illegible] of appliances inserted through the skin into broken bones, [illegible] in the light of existing evidence [illegible] practicability, and safety.

[illegible]

ILLUSTRATED CASE REPORTS AS AN AID IN SURGICAL TEACHING

ILLUSTRATED case reports as an aid in surgical teaching were presented at a recent meeting at which there were representatives of a number of teaching institutions. Comments led to the belief that the method is not widely employed and that its value is not generally appreciated; yet a trial of 5 years has proved it to be of much practical value and worthy of the consideration of clinical teachers.

When a clinical demonstration on a given subject is planned, it is usually well nigh impossible to secure cases which illustrate the lesions that are to be discussed and it is often impossible even to secure desirable cases which demonstrate the ultimate results of treatment. The difficulty is especially great if the same cases are requested to return serially for demonstration to successive sections of students or even once a year for successive classes. As a result, students see only those cases which are momentarily accessible, and these are for the most part the limited number which are in the hospital. Consequently, students do not profit by the material which has passed through the hospital in the past. Such material always presents cases which could be employed advantageously for teaching were the records in proper form.

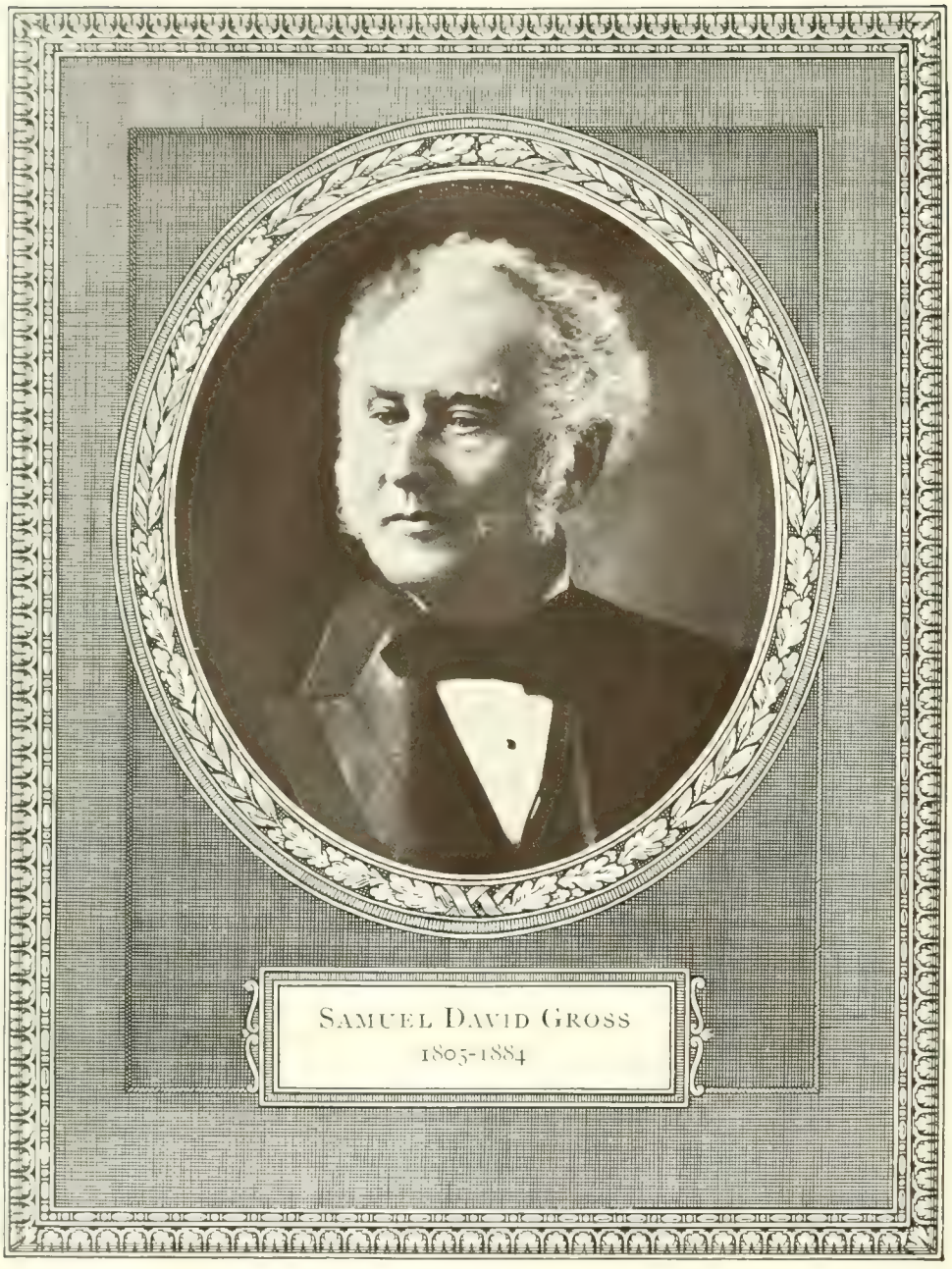
The deficiency of illustrative cases can be largely corrected by working up and filing type cases and unusual cases as they pass through the hospital, bearing in mind that

the hospital records are usually inappropriate and deficient for this purpose. Each member of the staff must be alive to the possible importance for teaching purposes of cases under care. With this in mind the proper selection of cases for this purpose is readily made. There is prepared a careful summary of the history and physical examination of cases, ante-operative photographs and X-ray prints. After operation, photographs of the gross specimen removed and photomicrographs of typical areas are incorporated with the record. The postoperative course is summarized. Photographs after operation are included as well as the ultimate results as determined by the "follow-up" examinations. In this way a complete record of the case is available for demonstration to students. Duplicate cases need not be accumulated but type cases should be replaced as more illustrative ones are secured. With such material one can demonstrate in a convincing manner the full course of individual cases or groups of cases. If, in the course of a clinic, a postoperative case is demonstrated, one can often utilize to advantage the ante-operative records and photographs of similar cases.

The method lends itself best to lesions or diseases where some abnormality can be registered in photograph or X-ray plate, as, superficial tumors, skin lesions, exophthalmic goiter, osteomyelitis, myositis ossificans, Paget's disease, and other deformities. But the field is far more extensive than appears at first sight if pathological material is included. Of course photographs are not as perfect records as colored illustrations or models, but are fairly good substitutes. The case records are grouped under subjects. These may be arranged in albums with removable leaves, an album being devoted to each subject, thus enabling an instructor to secure very quickly material to illustrate a clinical demonstration.

In a few years there is accumulated complete records of groups of cases and unusual cases. The method requires some work and foresight but the results will amply repay the effort.

EUGENE H. POOL.



SAMUEL DAVID GROSS
1805-1884

MASTER SURGEONS OF AMERICA

FOREWORD

American surgery is cosmopolitan. Students from the United States have pursued their studies in all the great hospitals and universities of the world, each bringing home something of value which has been promptly introduced into American practice. The zeal and enthusiasm of the American student both at home and abroad has led to profitable scientific research and medical and surgical investigations, the value of which has been recognized internationally. Science has no country, but scientific men are more or less influenced by the conditions in their own countries, and each country has its heroic dead whose life work contributed to scientific advance.

Sir Berkeley Moynihan has pointed out the value to the medical student of biographies of British surgeons that are appearing in the *British Journal of Surgery*, and suggests that the biographies of great American surgeons of the past be written that their lives may be familiar to all, and their deeds an inspiration to surgeons of this generation. The Board of Editors of the American College of Surgeons has acted on this suggestion and will publish in each issue of SURGERY, GYNECOLOGY AND OBSTETRICS a biography with a portrait of an American surgeon who, before passing beyond, has done his work well.

WILLIAM J. MAYO.

SAMUEL DAVID GROSS

SAMUEL DAVID GROSS, the elder Gross, as we all called him in order to distinguish him from his brilliant son and successor, Samuel W. Gross, my old master whom I loved and admired with all the enthusiasm of boyhood more than 30 years ago, was born in Easton, Pennsylvania, in 1805.

His great-grandparents came from the Lower or Rhenish Palatinate in one of the emigrations of the Seventeenth Century, from that portion of Germany which, before its devastating wars, had been a veritable garden spot. The soldiers of Louis XIV had interpreted literally the order of the Sun King to Louvois to burn up the country. They killed three-fourths of the people and destroyed

four-fifths of the property. In the Palatinate, Wallenstein and Gustavus Adolphus, Tilly and Spinola, Condé and Turenne performed some of their most sanguinary actions. They left the Palatinate a gory wilderness with the blackened ruins of homesteads, buildings, and churches and the land harried by great flocks of ravening wolves.

In the veins of Gross ran the blood of the calm, scholarly, patriotic, broad-minded, deep-thinking, home-loving, and philanthropic Palatines; of those men who abandoned home and country for the rights of free speech, of liberty, and of conscience.

Gross was brought up on a farm. He loved the country all his life and he knew and appreciated its magic. Nature was to him an endless pleasure. Birds, animals, the woods and especially flowers were to him a source of the utmost delight. He loved the sunrise with its glory of color and the sunset with its splendor of flame. He loved the blue depths of the heavens, the sea, the majesty of the storm, the starlight, and the stream.

He knew familiarly the flora of this entire region of Pennsylvania. He always kept flowers in his office and about his house, and he insisted on seeing them in hospital wards. Once in a hospital I saw him tenderly lift a flower, sadly comment upon how soon it would fade, saying: "It has but one Spring and we mortals go almost as quickly for we have but a few Springs." He had within him something of the Wordsworth feeling: "It is my faith that every flower enjoys the air it breathes."

He was educated in the common schools and started to study medicine under Doctor Swift, of Easton. After he had begun his study in Doctor Swift's office he made up his mind that he had not sufficient education for the proper study of his profession and he went back to school, finishing in the famous Academy at Lawrenceville, New Jersey. He then renewed the study of medicine, entering the Jefferson Medical College of Philadelphia, and being an office student of the celebrated Dr. George McClellan.

On his graduation he started practice in Philadelphia and eked out a livelihood by hack literary work and translations. He spoke German and he acquired a knowledge of French in the course of a few months in order to translate Alphonse Tavernier's *Elements of Operative Surgery*, in 1829. He translated the *Manual of General Anatomy*, by Bayle and Hollard, in 1828, and Jules Hatin's *Obstetrics* in the same year. In 1829 he translated Johann Valentin von Hildenbrand's *Treatise on the Nature, Cause, and Treatment of Contagious Typhus*. Tavernier's was the first treatise on operative surgery published in America and attained great success.

In 1830, two and a half years after his graduation, he wrote a work on *Diseases and Injuries of the Bones and Joints*, and although the book became popular, the liberal publishers never paid him a cent. Want of practice in

Philadelphia obliged him to move back to Easton. After remaining there for a time, he went to Cincinnati and from there to Louisville, where his fame was made.

In 1839 he published his great treatise on *Pathological Anatomy*, the first in the English language. He received not a single cent for the first edition. The work was a great success and made him broadly known in this country and in Europe. The book was a popular textbook for more than a quarter of a century.

In 1851 he published a treatise on *Diseases of the Urinary Organs*. Up to this time there had been no satisfactory treatise in the English lang[illegible] the only two existing being Brodie's *Lectures on the Diseases of the Urinary O[illegible]* and William Coulson *On Diseases of the Bladder and Prostate Gland*, both pub lished in 1842. This book, edited by the younger Gross, was still a popular textbook at the end of the 80's in the last century.

In 1854 he published his noted treatise on *Foreign Bodies in the Air Passages*. This was the very first attempt that had been made to present the subject in systematized form.

In 1859 he issued the first edition of his magnificent textbook on surgery; the greatest of his day, the first from America and probably the greatest ever written by one man. Recall the comprehensive nature of the title: *A System of Surgery, Pathological, Diagnostic, Therapeutic, and Operative*. The sixth edition was issued in 1882.

In the beginning of the Civil War, he wrote a *Manual of Military Surgery*. In 1861, he edited the *Lives of Eminent American Physicians and Surgeons of the Nineteenth Century*, writing several of the biographies himself. At times he edited medical journals. He contributed a multitude of articles to medical journals and had made some original researches of the first importance, espe cially those upon gunshot wounds of the intestines.

He had been a teacher in Cincinnati, in Louisville, in New York City before he came to his real home as a professor of surgery in the Jefferson Medical College. He was one of the greatest of surgeons and teachers. He founded the American Surgical Association. He was long the most influential member of the American Medical Association. He presided over the International Congress of Surgeons in 1876. He received high public honors in Germany, and was given the D.C.L. of Oxford, the LL.D. of Cambridge, the LL.D. of Edinburgh, and when actually on his deathbed, the LL.D. of the University of Pennsylvania.

His intellect was of the most comprehensive and luminous sort. He was a real surgical philosopher. Probably no greater mind was ever devoted to the science and art of surgery. He was a great man, a good man, and a gentleman; a master teacher and one who commanded not only the respect but the affection of the entire profession.

His old friend, Doctor Yandell of Louisville, wrote an epitaph which contains a just estimate of him. In this, Yandell states that Gross's life was one "unbroken process of laborious years," that he "filled chairs in four medical colleges in the Union and added lustre to them all." That "he recast surgical science, as taught in North America, formulated anew its principles, enlarged its domain, added to its art, and imparted fresh impetus to its study." Among the many books he composed is "A *System of Surgery* which is read in different tongues, wherever the Healing Art is practiced." "With a great intellect, carefully trained and balanced, he aimed with undivided zeal at the noble end of lessening human suffering and lengthening human life and so rose to the highest position yet attained in Science by any of his countrymen."

The writer of this brief memoir beheld the mighty leader a great many times, heard him lecture frequently and watched him operate, and in him always saw the embodiment of surgical learning, dignity, and distinction, and felt that fifty years of American surgery were speaking through his lips.

J. Chalmers DaCosta.

TRANSACTIONS OF SOCIETIES

CHICAGO GYNECOLOGICAL SOCIETY

Regular Meeting Held December 16, 1921, Dr. W. C. Danforth Presiding

THE INFLUENCE OF OVARIAN SECRETION ON HEMORRHAGIC TENDENCY

Dr. Arthur H. Curtis: I very recently operated upon a young woman of about 30 or possibly a little older who had two large chocolate cysts of the ovary, one the size of a fist, the other four or five times as large. There was almost no ovarian tissue left in the cortex of these cysts. This patient had been under the care of Dr. Oliver S. Ormsby for over 7 years. Every time the cutaneous surfaces were bruised ever so slightly she developed a hæmorrhagic area, at times as large as a saucer, over various parts of the body surface.

There arises the question as to whether the disturbed secretion of the ovary is an essential factor in the development of the hæmorrhagic tendency. I suppose some of you have seen similar cases, and I wish to ask whether other members have encountered similar dyscrasias through disturbances of the ovaries. The giving of a hypodermic injection the morning of the day preceding operation gave a great deal of pain and on the morning of the operation was accompanied by an ecchymosis that covered the entire arm. No hæmorrhage occurred on removing the ovaries. The coagulation time was 7 minutes 20 seconds before operation and 7 minutes 40 seconds a few days ago.

She had had feelings and symptoms of the menopause and I was wondering whether it was the ovarian cysts that disturbed menstruation.

THE X-RAY IN PREGNANCY; X-RAY EXAMINATION OF TEETH DURING PREGNANCY

Dr. Carl Henry Davis: In view of the paper on the use of X-ray in pregnancy which is to be discussed tonight, I wish to show films of a teeth pregnancy and a number of mouth films which show the importance of having all dead teeth X-rayed.

In the past 2 years it has been my unusual experience to have delivered six women of twins and one of triplets. In two instances it was impossible to determine the relative positions of the babies on account of excessive fluid and X-ray plates were secured. In the first case we were able by comparison of different films to demonstrate the babies' heads and determine the relative positions. This film of the second case was made with the Potter [illegible] to get much clearer pictures in this type of X-ray work. It shows both babies clearly.

Since I [illegible] etiology of toxæmias, I have been much more careful than formerly to have the teeth examined frequently during pregnancy. But dentists frequently [illegible] dead teeth and tell the patient that the mouth is in good condition. Within a year six patients have developed a more or less severe toxæmia which I believe might have been avoided had infected teeth been removed early in pregnancy. You will note in the films which are being passed that practically all of the dead teeth show infection.

It is my belief that the physician should require X-ray examination of all dead teeth and have showing definite infection removed as early as possible in pregnancy.

ADENOMA OF THE UTERUS; REMOVAL OF FOREIGN BODY FROM THE BLADDER

Dr. W. C. Danforth: [illegible] the paper by Dr. Sampson on "Adenoma of the Uterus." In this woman a mass existed which was definitely palpable in the [illegible] hæmorrhagic cysts of the ovaries, the larg [illegible] being on the left side and containing thick chocolate-colored fluid. A complete hysterectomy was done, there being very dense adhesions between the posterior wall of the uterus and the anterior rectal wall which rendered operation a rather difficult one. Upon section, an adenomatous growth was found in the [illegible] rium or endometrium-like epithelium in the [illegible] in this particular instance.

About 2 years ago Dr. Barrett showed us a very useful little stunt for removing foreign bodies from the bladder. He suggested the use of a small [illegible] water cystoscope alongside of which through the urethra might be passed a long, narrow K[illegible] forceps. I had no occasion to make use of this bit of technique until a few days ago, when a woman came into the hospital with a piece of catheter in the bladder. By introducing the cystoscope and [illegible]

difficulty to grasp the catheter and, after removing the cystoscope, to draw out the piece of catheter. It seems to be a rather valuable bit of technique.

THE TEST OF LABOR

Dr. [illegible] presented a paper entitled "The Test of Labor." (See p. 63.)

DISCUSSION

Dr. Rudolph W. Holmes: It is refreshing to have Dr. Lee present a summary of his obstetrical work, because of late years we have heard much of operations on the pregnant, and little of pure obstetrical care in labor.

In regard to one point I cannot quite agree with Dr. Lee on the question of bony obstruction. The crux of the problem is the cephalopelvic relationship. If there be a disproportion, it is an indication that perhaps there may be an insurmountable difficulty, but it does not necessarily follow. The molding of the head and the resistance of the soft parts play an important part. Take, for example, a vera of 9 centimeters, or as some would have it, 8 or 8½ centimeters, as the index between the relatively and absolutely contracted pelvis, spontaneous labor may be reasonably expected in a fully 90 per cent of such cases, and will terminate spontaneously, or at most in a not difficult forceps operation. In women with the above limitations, it has been my fixed rule that no valid determination of the woman's potential possibilities may be fixed unless she has had a real test of labor. I examined a woman recently who had a conjugata vera of 6 centimeters, yet she stated she had given birth in a short labor to a baby weighing 6 pounds (Swedish). I would have had some five to ten times the number of cæsareans I have had if I had relied on mere mensuration, and not on the test of labor.

Dr. Charles S. Bacon: I would like to ask Dr. Lee what he means by fœtal exhaustion. How is that determined?

I would question the indication for high forceps of posterior right or left position at the inlet. I am somewhat doubtful whether that has any bearing, for if descent occurs rotations forward will take place. The important thing is the treatment of these cases of delay at the inlet. I would not always consider a previous labor of 15 or 20, or even 30 hours as a complete "test of labor." The real "test" must be managed properly. With proper support of the patient and the relief of pain after 40 to 50 hours, the head may descend so that a low forceps operation can be made. Generally in these cases delay is due to lack of dilatation of the cervix and much time may be required to overcome this obstacle.

Dr. Carl Henry Davis: Dr. Lee's paper brings up the question of just how we should manage the cases where the head is high, particularly with the occiput posterior, when complicated by premature rupture of the membranes. It has sometimes seemed that the life of the baby might have been conserved in this type of case had we promptly introduced a Voorhees bag to dilate the cervix instead of leaving that entirely to the fœtal head. I would like to have Dr. Lee tell us his attitude relative to the use of a bag in this type of case.

Dr. Mack T. Goldstine: I would like to know how Dr. Lee picked this one hundred consecutive cases and how they were done, because the hundred shows a good deal more abnormality than is usual in the average one hundred cases. It is unusual to have only 15 spontaneous deliveries in primipara out of 51. Thirty nine multiparæ in this series is a high percentage to require help. To my mind he could not have picked a harder one hundred cases. I venture to say that if he chooses another hundred his percentage in favor of the test of labor will show up far better than this hundred showed.

Dr. W. George Lee (closing the discussion): Dr. Holmes I think misunderstood me in referring to bony obstruction. My point was that where the bony obstruction is great enough to influence one to do a cæsarean section primarily or after a few hours, in the first stage of labor, no test of labor is given, and hence an abdominal section is better done without waiting for the few hours of undetermined labor.

In answer to Dr. Bacon's question concerning fœtal exhaustion, I used that as a term for marked alteration in the fœtal heart tones, showing changes, and in some instances the passage of meconium. The change in fœtal heart tones is the most important sign.

In the matter of posterior fixation I think Dr. Bacon rather misunderstood me. I did not recite that as a factor for interference but merely that as a complicating factor this was present in an unusual number of cases.

As to the dry labors, I think the bags are beneficial in helping to dilate the cervical portion, but I think in many cases the constriction ring is on the head, and the bag does not help. I think in these cases the longer we delay the more firmly set is the constriction ring and an earlier interference seems justified. We then aid in dilating by aiding the muscle to overcome the resistance before the lower segments have "dug themselves in," so to speak.

Speaking of this particular series, Dr. Goldstine, I presented them because they seemed to me a very unusual series of cases, but I should dislike to think I would get another hundred with as great a number of cases needing interference. The majority of these cases I saw throughout labor.

ROENTGENOGRAPHY IN OBSTETRICS

Dr. D. A. Horner presented an inaugural thesis entitled: "Radiography in Obstetrics." (See p. 67.)

DISCUSSION

Dr. Joseph B. DeLee: This work has been done under my eye for the last 2 years, and I feel that we are achieving some real results. I formerly looked

upon the measurement of the pelvis as an almost impractical thing, but it seems to me now we have a scientific method of doing it. With the n[ormal] treatment of contracted pelvis we do not need these refined methods, but sometimes we are glad to have them. For example, in the breech presentation where it is highly desirable to give the people a live baby and we cannot give the test of labor. I shall refer to the test of labor only so far as the pelvic contraction is concerned. I grant [that] the test of labor is needed [in] other cases. I do not want such a test that proves her absolute physical inability to force a child through the pelvis. What I consider a good test of labor is when a woman has demonstrated to me her inability to complete the labor herself, with safety to both [mother] and child. Some damage has been done to the woman's nervous system, to the soft parts and possibly to the baby if the absolute test has been given. With this new X-ray method I think we shall escape the ne[cessity] of giving these women the prolonged test of labor.

There are many interesting things in the p[apers] shown. The pictures of the dead baby with mac[er]ated bones is a real advance and should be very useful. It is not always possible to tell beforehand whether the fœtus is dead, and since this may eventuate in infection, the X-ray may save an endless amount of trouble.

So far as the use of the X-ray on the fœtus is concerned, I think there is no danger. The demonstration that it is possible to measure the pelvis and also the baby is the most important thing in the paper, and it puts the real measurements of the pelvis more firmly on a scientific basis than ever before.

As Dr. Horner stated, there is a requirement in some states that there be a physical examination prior to marriage, and I believe it would be a very good thing for women to know if they are anatomically fit to have children, and this method [may] be helpful there.

Dr. Edward L. Cornell: Dr. Horner failed to mention the diagnosis of ectopic pregnancy by means of X-ray as demonstrated by me in [a case] where we employed pneumoperitoneum on a rather obscure mass in one of the tubes. The patient had gone by for a period of about 6 weeks. The only symptom was a complaint of pain. We did a pneumoperitoneum, demonstrated the mass in the tube, and removed the ectopic before rupture.

Dr. Irving F. Stein: At Michael Reese H[ospital] we have been much interested in similar en[deavors] and I would like to show a picture of one case in which life had not yet been felt. The patient, a para-II, age 19, presented herself at the prenatal clinic having had one normal labor, and said that about one month previously the water had [gone] and that she felt no life. We were unable to demonstrate either fœtal movement or heart tones in the clinic, or the ward where we watched her for 6 days. The X-ray film showed the head very distinctly and the fœtal spine in this area, the fœtus lying trans[verse] presenting. This did not show with any great degree of clearness on account of the [fact] that it was difficult to [get] the [fœtus] [in] [the] [pelvis] [and] [was] [not] filled during the night, and was not saved for measurement. The findings on examination was in anteflexion and filled the pelvis [fully] and [the] [uterus] [was] [not] [easily] [ex]tract[ed]. The patient stated that she had felt life. Her last period was on October 28, 1920, and she [stated] [that] [on] [April] [17], she then should have been about 5½ months pregnant. The fœtus probably developed to 4½ months. We [were] [unable] [to] [obtain] [fœtal] [move]ments audible through the stethoscope, but were unable to get either heart tones or other evidence of life. I think this case is decidedly younger than the one Dr. H[orner] showed.

Dr. D. A. Horner: This work has been done in Dr. DeLee's laboratory and I wish to thank him for the opportunity of being able to do it. I think that with a little more application of time to the [problem] [of] [the] [technic] something really simple and valuable will be developed; something that will be accepted as essential. This method is not original with me. I am simply carrying [out] [the] [work] of Chamberlain and Newell.

To illustrate the case referred to by Dr. Cornell, I present this plate. It shows the pneumoperitoneum, the uterus slightly enlarged and off to one side and the tumor mass distinctly visible, with an enlargement of the tube and a portion of the [ovary] on the other side. The diagnosis of early pregnancy [was] [not] taken. From the history of amenorrho[ea] and the conditions revealed in this plate, a diagnosis [was] confirmed the diagno[sis].

Dr. N. Sproat Heaney: Dr. Horner spoke about the plate of the woman who was 5 months pregnant [and] the woman was 5 months pregnant according to the menstrual period and 5 months according to the plate of the fœtus. He did not say how he [got] [that] [data], but he made a very definite statement regarding this. I am not aware that one can tell accurately [anything] [regarding] [the] [age] [of] [the] [fœtus] [from] [the] [plate] [or] their density even when these factors are deter[mined].

Dr. D. A. Horner: My remarks pertaining to roentgenography of the unmarried woman to determine her fitness to marry and bear children, hold true for all women giving histories of previous obstetrical difficulties. There are numerous communities in which there is no one able to take [the]

of the borderline cases correctly. Many large sized [illegible] are [illegible] the most inferior sort, and in these as in all localities occur [illegible] like the one I presented, where there was an [illegible] Nature is depended on. Difficulty is discovered later. Then comes faulty interference. Not a few die as a result. One capable of deciding early and performing the different types of cæsarean section, if at hand, would eliminate this question of fitness to marry as judged from the obstetrical viewpoint.

[illegible] all of these pictures are taken at a standard height. The ray comes from the highest altitude which the stand permits. Therefore, every picture we take can be graded; a standard for every period can be set for that particular distance. At a distance of six feet, if we were taking them from that distance, they would be almost the same size as the fœtus *in utero*. The works of Hess and Adair, published not so long ago, gives us [illegible] ation details to obtain the age of the fœtus. Any textbook of obstetrics gives measurements which can be applied here. We judged that this [illegible] months by comparing it with the film size of our 6 months' fœtus.

Dr. N. Sproat Heaney: I am not a radiologist nor a mathematician, and am, in consequence, not able to speak upon the technical points involved in Dr. Horner's paper. There are a few practical facts, however, which I do know. In reference to measuring the size of the 5 months' fœtus previously spoken of, if our constant factors are the heights of the tube and the level of the plate the object which we are taking is the variable point and if we are to measure its size we are to first determine its location. There is a considerable range of possible mobility in a 5 months' pregnancy. From the cervix to the fundus is a considerable distance, particularly since at this time we have a relative hydramnios. At this period of gestation the size of the uterus is disproportionate to the size of the fœtus. For that reason I am not convinced by the evidence that Dr. Horner has given us, that he can determine the size of the bones of a 5 months' fœtus. I, of course, may be mistaken in this and ask for further elucidation.

Dr. D. A. Horner: If you will recall, the unknown line is purposely put at an angle. It is immaterial how far it is from the plate as long as it is below the target. Its length is solved with those equations and figures (indicating) obtained with plane geometry. This may be a line on the fœtal head or on the pelvis, it will make no difference. The ultimate figure as shown in the model is a right trapezoid with the unknown line at the top. If you lift that line any distance above the plate or lower it, the equations remain identical.

Dr. Rudolph W. Holmes: Dr. Horner has presented a very interesting study, but I wonder what real clinical value his mathematical-geometrical deductions have. Of what value is the 76/100 unless you likewise may have the same precise mathematical figures for the whole pelvis from inlet to outlet, both anteroposterior as well as transverse. Further we must demand the same mathematical determination of the fœtal head in all obstetric planes. Again, no adequate determination of pelvocephalic relationship is realized unless the condition of the maternal soft parts and the degree of moldability is properly interpreted. As a theoretic consideration Dr. Horner's paper is a treat, as a practical suggestion for the bedside I fear it is not practicable. After all, the acumen of the trained obstetrician aided by an intelligent palpation offers more than any method of precise mensuration.

Dr. D. A. Horner: If we get the head through the pelvis we are satisfied that the rest of the fœtus will come through. The problem is not a matter of the soft parts. The greatest resistance we have to overcome is not the cervix or other soft structures, but the bony pelvis of the mother. Someone a while ago, advised using a bag in the difficult cases, stating that it would overcome the soft parts. Manual dilatation or incisions of the cervix and vagina will also overcome the resistance of these soft parts if the difficulties of the labor arise there. The resistance of other normal structures is negligible.

CORRESPONDENCE

THE BIOGRAPHY OF EPHRAIM McDOWELL

To the Editor: I am glad to have this opportunity to reply to Dr. L. S. McMurtry's letter published in correspondence in the May number of SURGERY, GYNECOLOGY AND OBSTETRICS concerning the biography of Ephraim McDowell.

As fully explained in the foreword, the biography is the outcome of a personal experience of mine in Berlin in 1911, when I was told that the belief was current in Germany that McDowell's first ovariotomy was performed upon a negress. In clearing up this doubt, I must repeat that I was impressed with the conflicting versions, dates, and the omissions that I encountered in print and correspondence. I have dealt with these at length in the biography.

My chief aim in writing the biography of Ephraim McDowell was to arouse the interest of the medical profession and of the public in this benefactor to untold coming generations, so that he might receive honors commensurate with the importance of his labors.

In trying to fulfill this ambition I was careful not to overlook any opportunity to emphasize as effectively as I knew how this long continued neglect to do him justice. But I did not have the least thought of offending any person or organized body of persons. I relied on the breadth of view of my readers to appreciate the magnitude of this neglect in comparison with his work and to understand my earnestness in trying to secure just recognition for him among his own countrymen. I was also humbly endeavoring to bespeak for him attention beyond our shores. One who so profoundly influenced his profession and the human race for all time to come does not belong to any country. He belongs to the world, and his work was therefore not written en-

value, as well as the included with a view of making the presentation as today and in future periods. I tried to do

make only tradition of the

Concerning our version of the removal of the remains of Dr. and Mrs. McDowell, I will say that it is similar to that published by his granddaughter has until now remained unchallenged. Furthermore, this same version was corroborated and even elaborated at the first grave of Ephraim McDowell in the Shelby burial ground in 1912, by a kinsman of his in the presence of a witness. I might add that the topographical appearance of the former grave lent color to this kinsman's remarks, and the discovery of the fragments of the first tombstone followed later.

In my book I have also expressed the hope that other biographies will be written, and I have included the minute details with a thought of others in just such an undertaking.

Dr. McMurtry's idea of a lectureship in the American College of Surgeons, similar to the Hunterian in the Royal College of Surgeons, has my unqualified support and approval. If the book had

Louisville, Ky.

THORACOSCOPY

To the Editor: In a paper on thoracoscopy by Dr. H. C. Jacobaeus published in the March number of SURGERY, GYNECOLOGY AND OBSTETRICS, I find a statement which is so at variance with the experience of thoracic surgeons in America that I can not let it pass unchallenged.

Dr. Jacobaeus says: "For, as we know, we have nothing for examining the chest cavity which corresponds to the exploratory laparotomy for examining the abdominal cavity."

Now, as a matter of frequent experience I have found, and I am sure that other thoracic surgeons have also found that a wide intercostal exploratory operation is far more thorough than the complete exploratory laparotomy and this exploratory thoracotomy is practically devoid of shock. most of the patients being able to be out of bed 4 or 5 days afterward and, in my even earlier. Contrasted with the condition of a laparotomized patient with complete exploration of the abdominal cavity the vincing. Also, at such an operation specimens may be removed with the minimum danger and a more perfect understanding of all the patho-

[illegible] present can be had than in any [illegible] way.

I agree with Dr. Jacobaeus that the thoracoscope may have its uses, especially the one for which I understand it was originally devised, namely, to divide adhesions in tuberculous cases preparatory to lung collapsing pneumothorax, but thoracoscopy has shown in the doctor's 50 patients 10 cases, or 20 per cent, in which there were complications which must be considered serious, so the procedure can hardly be considered in the light of a minor surgical examination.

I shall watch with great interest the further development in this method of exploration of the chest cavity.

HOWARD LILIENTHAL.

New York.

INGUINAL HERNIOTOMY UNDER REGIONAL ANÆSTHESIA

A CORRECTION

In my article on "Inguinal Herniotomy Under Regional Anæsthesia," which appears on page 398 of the March, 1922, issue of SURGERY, GYNECOLOGY AND OBSTETRICS, an error has been made in the placing of the illustrations. Figure 8 should be transposed to appear over legend for Figure 5; and Figure 5 should be transposed to appear over Figure 8.

GASTON LABAT, M.D.

Paris, France.

BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

TUMOURS, INNOCENT AND MALIGNANT; THEIR CLINICAL CHARACTERS AND APPROPRIATE TREATMENT. By Sir John Bland-Sutton, LL.D., F.R.C.S. 7th ed. London, New York, Toronto, and Melbourne: Messrs. Cassell & Company, Ltd., 1922.

THE THYROID GLAND; CLINICS OF GEORGE W. CRILE AND ASSOCIATES. Philadelphia and London: W. B. Saunders Company, 1922.

SURGICAL AND MECHANICAL TREATMENT OF PERIPHERAL NERVES. By Byron Stookey, A.M., M.D. With a chapter on Nerve Degeneration and Regeneration by G. Carl Huber, M.D. Philadelphia and London: W. B. Saunders Company, 1922.

RADIUM THERAPY. By Dr. Frank Edward Simpson, A.B., M.D. St. Louis: C. V. Mosby Company, 1922.

THE PLACE OF VERSION IN OBSTETRICS. By Irving W. Potter, M.D., F.A.C.S. St. Louis: C. V. Mosby Company, 1922.

TRANSACTIONS OF THE TWENTY-SECOND ANNUAL MEETING OF THE AMERICAN PROCTOLOGIC SOCIETY. Boston, June 3, 4, 6, 1921. New Bedford, Massachusetts: George H. Reynolds, 1922.

TRANSACTIONS OF THE AMERICAN GYNECOLOGICAL SOCIETY. Vol. xlvi, 1921. Edited by George Gray Ward, Jr., M.D. New York, 1921.

TRANSACTIONS OF THE AMERICAN SURGICAL ASSOCIATION. Vol. xxxix. Edited by John H. Jopson, M.D. Philadelphia: Wm. J. Dornan, 1921.

THE SURGICAL TREATMENT OF NON-MALIGNANT AFFECTIONS OF THE STOMACH. By Charles Greene Cumston, M.D., and Georges Patry, M.D., with an introduction by Sir Berkeley G. A. Moynihan, K.C.M.G., C.B., M.S. Philadelphia: J. B. Lippincott Company, 1921.

LES OCCLUSIONS AIGUES ET SUBAIGUES DE L'INTESTIN. By A. C. Guillaume. Paris: Masson et Cie, 1922.

OPIATE ADDICTION; ITS HANDLING AND TREATMENT. By Edward Huntington Williams, M.D. New York: The Macmillan Company, 1922.

CHIRURGIE DE L'APPAREIL GÉNITAL DE LA FEMME. By R. Proust and J. Charrier. 5th ed. Paris: Masson et Cie, 1922.

THE PRINCIPLES OF PHYSICS AND BIOLOGY OF RADIATION THERAPY. By Dr. Bernhard Kroenig and Dr. Walter Friedrich. Authorized English edition with appendix. New York: Rebman Company, 1922.

MANUAL OF OBSTETRICS WITH CHAPTER ON ENDOCRINOLOGY. By John Osborn Polak, M.Sc., M.D., F.A.C.S. 2d. ed. New York: Physicians and Surgeons Book Company, 1922.

OBSTETRICAL NURSING; A TEXTBOOK ON THE NURSING CARE OF THE EXPECTANT MOTHER, THE WOMAN IN LABOR, THE YOUNG MOTHER AND HER BABY. By Carolyn Conant Van Blarcom, R.N. New York: The Macmillan Company, 1922.

TASCHENBUCH DER FRAUENHEILKUNDE. By Dr. Koblanck. 3rd ed. Berlin and Vienna: Urban and Schwarzenberg, 1922.

COLLECTED PAPERS OF THE MAYO CLINIC. By Mrs. M. H. Mellish. Vol. xiii, 1921. Philadelphia: W. B. Saunders Company 1921.

BIRTH STATISTICS FOR THE BIRTH REGISTRATION AREA OF THE UNITED STATES. 1920. Sixth Annual Report. Department of Commerce, Bureau of the Census. W. M. Stewart, Director. Washington: Government Printing Office.

CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

TWELFTH ANNUAL SESSION, BOSTON, OCTOBER 23–27, 1922

JOHN B. DEAVER, Philadelphia, *President*
HARVEY CUSHING, Boston, *President-Elect* ALBERT J. OCHSNER, Chicago, *Director*
FRANKLIN H. MARTIN, Chicago, *Director-General*

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FREDERICK J. COTTON	FLORENCE W. DUCKERING	FRED B. LUND	JAMES S. STONE

PLANS FOR THE BOSTON MEETING

UNDER the guidance of a representative committee of Boston surgeons the plans for the twelfth annual session of the Clinical Congress of the American College of Surgeons, to be held in Boston, October 23–27, 1922, are well under way. In general the plans for the Boston meeting will conform to those of recent sessions of the Congress, and will include clinical demonstrations in the hospitals and medical schools during the morning and afternoon hours daily, with scientific sessions each evening.

Conferences on problems related to the hospital standardization program of the College are to be held Monday morning and afternoon in Jordan Hall. Papers will be contributed and discussed by Fellows of the College, hospital superintendents, trustees, nurses, and others interested in hospital problems.

At the Presidential Meeting, to be held in Symphony Hall on Monday evening, the President-Elect, Dr. Harvey Cushing, will be inaugurated and deliver the annual address. On the same evening Professor Raffaele Bastianelli of Rome, Italy, will deliver the John B. Murphy Oration in Surgery.

Clinical demonstrations at the hospitals and medical schools will occupy the morning and afternoon hours of Tuesday, Wednesday, Thursday, and Friday, and under the leadership of the Committee on Arrangements noted above, we may expect a program of clinics and demonstrations to be developed that will accurately and completely represent the clinical activities of that great medical center. All departments of surgery will be represented in the clinical program, including gynecology, obstetrics, orthopedics, urology, surgery of the eye, ear, nose, throat and mouth, experimental surgery, surgical pathology, roentgenology, etc.

An interesting program of papers and discussions dealing with surgical subjects of present-day importance is being prepared by the Executive Committee of the Congress for sessions in Jordan Hall on Tuesday and Thursday evenings, in which eminent American and European surgeons have been invited to participate.

On Wednesday evening members of the Congress will be guests of the Boston Surgical Society at a special meeting in Jordan Hall for the presentation of the Bigelow medal.

The tenth convocation of the American College of Surgeons will take place on Friday evening in Symphony Hall, when fellowship in the College will be conferred upon a group of American and Canadian surgeons, and honorary fellowships upon the distinguished foreign guests.

...ral headquarters for the Congress will be established at the Copley-Plaza Hotel where the ... allroom, foyers adjacent thereto, and other ... the main floor have been reserved for the use of the Congress, and will be utilized for registration and ticket bureaus, bulletin ...

The annual business meeting of the American College of Surgeons and the Clinical Congress will be held in Jordan Hall on Thursday afternoon ... ock.

Application for reduced railway rates has been made to the railway passenger associations, and it is confidently expected that a substantial reduction in fares will be granted for the meeting.

... ADVANCE REGISTRATION

It has been found necessary in recent years to adopt the plan of limiting attendance because of the popularity of these annual clinical meetings. Such plan necessitates registration in advance on the part of all who wish to attend. The limit of attendance will be based upon the result of a survey of the amphitheaters, lecture rooms, and laboratories in the several hospitals and medical schools as to their capacity for accommodating visitors. When the limit of attendance has been reached through advance registration no further applications can be accepted, hence the necessity for early registration. It has been our experience in recent years that the limit of attendance will be reached some weeks in advance of the meeting.

CLINIC TICKETS

The use of special clinic tickets has proven an efficient means of providing for the distribution of the visiting surgeons among the several clinics, and as well insuring against overcrowding. The number of tickets issued for any clinic is limited to the capacity of the room in which that clinic is to be given. Attendance at all clinics and demonstrations is controlled by means of such clinic tickets, which are issued each morning at ... o'clock for that day's clinics.

As at previous meetings, a complete schedule of the day's clinics will be posted on bulletin boards at headquarters during the afternoon of the preceding day. After the program has been so posted, reservations for tickets for the next day's clinics may be filed, the tickets to be issued the following morning at 8 o'clock. A printed program will be issued each morning which will contain the complete clinical program for the day, with an announcement of evening sessions and other information.

REGISTRATION FEE

Plans for the Congress provide that no financial burden may be imposed upon the members of the profession in the city entertaining the Congress. Hence a registration fee of $5.00 is required of each surgeon attending the annual clinical meeting, such fees providing the funds from which to meet the expenses of conducting the meeting. To each surgeon on registering in advance is issued a formal receipt for the registration fee which receipt is to be exchanged for a general admission card upon his registration at headquarters in Boston. This card, which is non-transferable, must be presented to secure special clinic tickets and for admission to the evening meetings.

STATE AND PROVINCIAL SECTIONAL MEETINGS OF THE CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

The Spring series of group meetings of the College came to a close with sessions of the New England Section at Portland, Maine, May 15 and 16, and of the Maritime Provinces at Halifax, Nova Scotia, May 19 and 20.

NEW ENGLAND SECTION

The Portland meeting was the largest medical gathering which the state of Maine has ever seen, and, due to an efficient local committee, all arrangements ran with perfect smoothness. An interesting and well balanced clinical program was arranged at the Maine General Hospital, the Eye and Ear Infirmary, and the Children's Hospital.

Over four hundred people, many of them laymen, crowded the hospital conference on Monday afternoon and listened to a program devoted to hospital betterment. Speakers from the central office included the director general of the College, Dr. Franklin H. Martin, Reverend C. B. Moulinier, S. J., president of the Catholic Hospital Association, and Mr. T. E. Allen.

In addition, Dr. John Osborn Polak presented the advantages of standardization to the surgeon; Dr. George H. Stone, superintendent of the Eastern Maine General Hospital, explained the hospital executive's attitude toward standardization; and Mr. Robert Jolly, superintendent of the Baptist Hospital, Houston, Texas, spoke on "Why the Public is Interested in Better Hospitals."

The round table discussion on hospital betterment, which proved such a great success in the South, concluded this program. Under the leadership of Dr. M. T. MacEachern, superintendent of the Vancouver General Hospital, and director general of the Victorian Order of Nurses, an instructive discussion of pertinent hospital problems was held with speakers from the audience participating. This round table discussion is steadily increasing in value and serves to give local hospital superintendents an opportunity to discuss their specific problems.

Portland citizens turned out *en masse* to the community health meeting. They filled the City Hall Auditorium and crowded the balcony. An audience of more than 2,500 people listened with the greatest interest and showed that the public of Portland possessed a community conscience in hospital affairs.

Dr. John F. Thompson of Portland, Maine, presided at the meeting, introducing Honorable Percival P. Baxter, Governor of Maine, who made the address of welcome. The other speakers were as follows:

[illegible]

Clinics were continued on the second day, May 16, and the meeting closed with a scientific session presided over by Dr. Edville G. Abbott, chairman of the Maine executive committee. The program for this meeting follows:

Pelvic Inflammation. John Osborn Polak, M.D., Brooklyn, N. Y.

The Relations between the Surgeon and the [illegible] Pathologist. George Burgess Magrath, M.D., Boston, Massachusetts.

Certain Problems in Co[illegible]

MARITIME SECTION

No more enthusiastic meeting of the College has ever been held than that of the Maritime Section, which convened in Halifax on May 19 and 20. Fellows of the College from all the Maritime Provinces were in attendance, together with a number of medical men drawn from Nova Scotia, New Brunswick, and Prince Edward Island.

A carefully prepared program of clinics at the Victoria General Hospital, Camp Hill Hospital, and the Children's Hospital occupied the fellows on the mornings of May [illegible]

A large representation [illegible] School for the Blind [illegible] hospital conference one of unusual interest. The same topics were [illegible] at Halifax as at Portland, with the exception that Dr. Arthur Morse, professor of obstetrics and gynecology of

the Yale Medical School, spoke on "Hospital Standardization from the Surgeon's Standpoint."

The round table discussion, led by Dr. MacEachern, gave rise to an exceedingly valuable exchange of ideas regarding hospital problems and conditions in Maritime Canada.

The School for the Blind was crowded again at eight o'clock in the evening, when Dr. H. K. MacDonald, chairman of the Nova Scotia Section, introduced His Honor McCallum Grant, Lieutenant-Governor of Nova Scotia, who welcomed the visiting surgeons to the Province.

The program for the meeting follows:

The American College of Surgeons, Scientific Medicine. Franklin H. Martin, M.D., Director General, American College of Surgeons.

What Scientific Medicine is Doing for the Prospective Mother. Arthur Morse, M.D., New Haven, Connecticut.

The Work of the American Society for the Control of Cancer. John Stewart, M.B., C.M., Halifax.

Better Hospitals. Rev. C. B. Moulinier, S.J., President, Catholic Hospital Association.

Hospital Standardization and the American College of Surgeons. Malcolm T. MacEachern, M.D., C.M., Superintendent, Vancouver General Hospital, Vancouver, B. C.

How You Can Aid Your Hospital. Mr. Robert Jolly, Superintendent, Baptist Hospital, Houston, Texas.

At two o'clock Saturday afternoon a scientific session was held at Dalhousie University with the following speakers:

H. K. MacDonald, M.D., Chairman, Presiding.

Resections of the Knee Joint. Ross Miller, M.D., Amherst, N. S.

The Actual Cautery. John Stewart, M.B., C.M., Halifax, N. S.

An elaborate dinner given at the Halifax Club to the Fellows of the College closed the session. An executive committee for the ensuing year was elected for the Maritime Provinces, and, by unanimous vote, St. John was selected as the next meeting place.

Traumatic Asphyxia.—Thomas M. Green.

SURGERY, GYNECOLOGY AND OBSTETRICS

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TRAUMATIC ASPHYXIA

BY THOMAS M. GREEN, M.D., F.A.C.S., WILMINGTON, NORTH CAROLINA

TRAUMATIC asphyxia is perhaps one of the most remarkable conditions we are ever called upon to witness, especially with regard to the appearance of the victim; and yet the pathology is rather simple, most cases recovering in spite of other injuries which accompany it. Indeed, the injuries which accompany it are frequently more severe than the traumatic asphyxia.

This condition is brought about by compression of the chest and abdomen over an extended period of time, causing a suspension of the respiratory function. Judging from the literature on the subject, it seems a rather rare condition, only a handful of cases having been reported during the past half century.

It was described first by Olliver, later by Tardieu, and then by Hardy, who first observed the condition in victims of panics who were crushed in the efforts of the crowd to leave a building or a very crowded area. The reported cases exhibited certain striking and more or less constant characteristics, i.e., the appearance of the skin, head, face and neck, differing only in degree. The color of the skin becomes a dark red to purple, and the discoloration may be discrete or confluent, covering the face and neck, extending sometimes as far down as the third rib on the chest. On the posterior surface the discoloration may extend down to a line across the shoulders at the level of the lower border of the trapezius muscles, producing the so called "double trapezius triangle." Sometimes the discoloration is shown on the arms. Subconjunctival hæmorrhages are common to all cases, while hæmorrhages from the nose, mouth, and ears frequently occur. Other common points of discoloration are the pleura, pericardium, and abdominal viscera. These latter places are the sight of punctuate ecchymoses in all types of suffocation. The blood is dark and venous with increased fluidity, due to the exclusion of atmospheric oxygen. Other symptoms frequently accompanying the condition are unconsciousness, brief or prolonged, respiratory or cardiac depression, pulmonary engorgement associated with râles and bloody expectorations. Convulsions are not uncommon and occur not only with resumption of consciousness, but during several days following. Despard thinks they cannot be explained by the engorgement of the cerebral vessels, nor by toxæmia arising from the asphyxiated state. He believes that they are due to respiratory interference from injury to the phrenic nerve.

We must remember that in this type of asphyxiation we are not only dealing with the withholding of air from the lungs, but that the venous blood in the large veins of the thorax, neck and head has been forced backward into the capillaries of the skin by the compression of the chest and abdomen, thus producing an intense discoloration of the skin. Perthes explains the sharp limitation of this discoloration by lack of competent valves in the veins of the head.

(There are no valves in the innominate and internal jugular veins, except a pair where the jugular enters the innominate. These are irregular and incompetent. There are two pairs in the external jugular, one at its junction with the subclavian and the other just above the clavicle Both sets of valves are incompetent.) Huerter in explaining this discoloration thought that it was due either (1) to the extreme distention and rupture of the vessels of the skin of the face and neck from the sudden upward pressure; or (2) that the pressure on the abdominal and thoracic sympathetic nerves produces vasomotor paralysis, which results in the distention of the vessels with blood. Perthes accepts Huerter's first explanation, but believes that the capillaries are actually ruptured and allow the blood to be extravasated into surrounding tissues. Burrell and Crandon believed the condition to be due to vasomotor paralysis, accepting the second explanation of Huerter. It remains for Beach and Cobb to show conclusively in their exhaustive treatise that it was not an extravasation of the blood outside of the vessels, but that the intense pressure from the blow had forced the venous blood upward against the incompetent valves and backward into the capillaries of the face and neck. This they proved beyond question by removing sections of skin for microscopic study. The discoloration is inclined to blanch a little on pressure and clear up rapidly without going through the various stages of discoloration as shown where blood is extravasated into the tissues.

The treatment of the condition consists in the use of stimulants, applications of oxygen and artificial respiration. Ruppanner finds that most cases that recover consciousness from the original injury go on to complete recovery. Many show the so-called "contusion pneumonia" about the third day. He finds the prognosis should be guarded as to vision, since optic nerve atrophy and opaque patches of the macula have been reported. Parker reported optic atrophy produced by traumatic asphyxia. In his analysis of a number of cases he finds the pupils often fail to respond to light. Longe also notes this.

The case in question is that of a male, 38 years of age, by occupation a pipe fitter, who had previously done some diving while in the Navy. Subsequently, after an accident at the local shipyard, he offered to go down in a diving suit and ascertain the damage to one of the vessels. For some reason while at a depth of 37 feet, his air connection became interfered with for a period of 10 minutes and when taken out of the diving suit he showed the characteristic appearance of traumatic asphyxia. He was never unconscious; was having small hæmorrhages from the mucous membrane of the eyes, nose, mouth, and rectum. Respiratory function was very shallow and irregular, but improved immediately with artificial respiration and oxygen. His mentality seemed to be normal after the accident. His face was swollen and markedly discolored. The discoloration went as low as the third rib in front and on the back outlined the double triangle formed by the trapezius muscles. This discoloration began at the margin of the hair as a deep red and gradually merged into a dark purple. It disappeared rapidly and was practically all gone at the end of the fourth day, except the eyes which faded very much more slowly. He was discharged from the hospital at the end of the fifth day. There was never any permanent disability as a result of the accident. The pressure on his body through a diving suit at a depth of 37 feet would be about 18½ pounds to the square inch. The helmet was rigid and prevented this pressure from being exerted on his neck and head, so the forces acting were similar to squeezing of the abdomen and lower thorax for a similar length of time and technically called a "squeeze" by divers.

Other cases found in literature which manifested the skin discoloration and other symptoms in a more or less degree are as follows:

Huerter reports two cases: one of his own occurring in a boy of 15 caught in a threshing machine; the other a case of Vogt of a boy of 15 run over by a wagon.

Perthes reports two cases: one of a boy of 14 caught in a cotton mill, being crushed between a wagon and the handle of a cylinder; the other the case of a man of 36 who was crushed between a wagon and an iron post.

Baum cites the case of a male of 20, injured by a stone wall falling and pinning him to the ground.

Burrell and Crandon report a case of a male 22 years of age whose chest was caught between an electric car and a door post and held for 3 minutes.

Beach and Cobb report an interesting case of a male of 30 years whose chest was crushed beneath an elevator for 5 minutes.

Henry reports a case of a man of 20, crushed between iron pillows, who recovered from the traumatic asphyxia, but died from sepsis.

Winslow cites the case of a man of 22 who was bent against the ceiling in an ascending elevator.

Robertson describes a case of a child of 13 years caught between the cow catcher of an electric car and the ground.

Ruppanner reports four cases, two of which were women injured in a panic following a fire in a theatre, the other two being men, one crushed between a wall and a great weight and the other rolled by a tram car.

Beatson presents a case of a man of 24 years, who [illegible] bent down and [illegible]

Ryerson describes a case of a boy who was injured by being compressed between the springs and wheels of a wagon.

Bolt cites the case of a man of [illegible] thorax were crushed between two cars. This man died the twenty-seventh day after the injury.

Ettinger reports the case of a young man who was tramped on by a mob.

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HYPERPLASIA OF THE RUDIMENTARY LYMPH NODES OF THE PROSTATE

By Nobuyuki Fukase, M.D., [illegible]

VERY little has been written upon the normal anatomy of the lymphatic system of the human prostate, and nothing about the pathological conditions of this system. Most of the statements made concerning the prostatic lymphatic apparatus are based upon studies of the dog's prostate. Although mentioned by Mascagni, the prostatic lymphatic system was first described in detail by Sappey (1854), as a widely distributed network of vessels throughout the gland, converging into two collecting ducts on each lateral surface of the prostate, the upper and smaller trunks running to the obturator lymph nodes, while the lower and larger terminate in the internal iliac nodes. According to Caminiti the lymphatic network is most abundant in the middle portion of the prostate, moderately well developed in the base, and scantily developed in the apex. The endothelial cells of these lymphatic vessels are lozenge or polygonal in shape and contain numerous fine granulations in their cytoplasm.

Poirier and Cunéo, 1904, accepting the work of Cunéo and Marcille, describe the prostatic lymphatics as arising in fine capillaries arranged in the form of a network around each glandular acinus. From this periacinous network there run larger vessels toward the periphery of the gland where they form a periprostatic network from which the collectors start. These are symmetrically arranged on each side of the gland and run in four different directions. A primary trunk starts from the posterior surface of the prostate, and runs on to the bladder between the vasa deferentia, ultimately terminating in the middle gland of the external iliac group. This ascending channel frequently consists of two trunks which then terminate in the middle and superior glands of the middle chain. A second collector arising from the posterior surface of the prostate accompanies the prostatic artery, running upward, outward, and backward, terminating in one of the middle glands of the hypogastric group. In the neighborhood of the prostatic origin of this trunk two or three small glandular nodules are almost constantly present. Two or three other collecting trunks also start from the posterior surface of the gland, and run downward and backward, and ascend on the anterior surface of the

sacrum, the shorter and more external ending in the lateral sacral glands internal to the second sacral foramina, while the larger and more internal pass as far as the promontory to terminate in the glands situated there. From the anterior surface of the prostate a descending trunk runs to the pelvic floor, ultimately terminating in one of the hypogastric glands.

As to the existence of rudimentary lymph nodes associated with the lymphatic system within the prostate there are very few observations in the literature. Walker (1900) studied both animal and human prostates, and determined the existence of lymph nodes within the gland. He found them generally situated near the lateral surfaces, in groups of two or three nodes consisting of closely packed lymphoid cells surrounded by a thin capsule of connective-tissue fibers that extend into the peripheral layer of cells, but not deeper. In the central portion of these lymphoid collections, there is an extremely fine reticular network. Throughout the gland, along the lymphatic vessels, there are scattered small groups of lymphocytes representing more rudimentary lymph nodes.

Weski (1902) studied an island of lymphoid tissue that Waldeyer had found in a dog's prostate, regarding it as a pathological condition, although no other evidences of disease were present. In 1903 he reported the occurrence of lymphoid nodes in two human prostates, located just beneath the epithelium of the acini, and concluded that they were normal structures.

Koelliker, in his textbook, 1902, describes the lymphoid nodes of the prostate, as found by Walker, and adds that such nodes are very rarely found as dense groups of lymphocytes beneath the mucosa of the prostatic urethra.

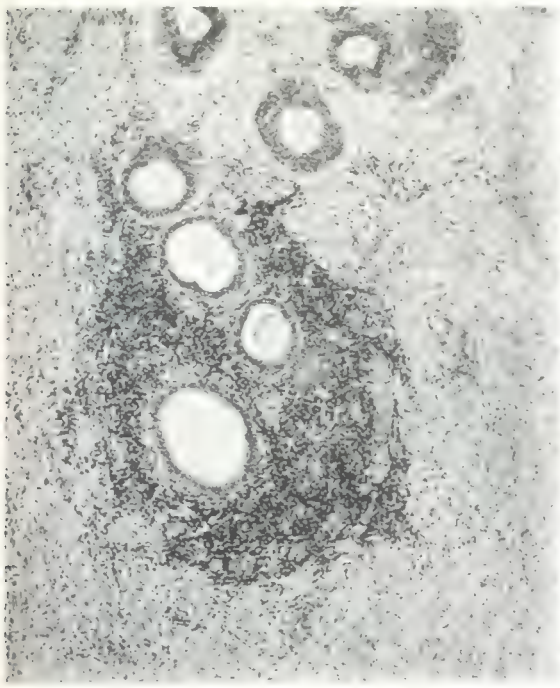
Many authors, however, still do not recognize either the existence or significance of such intraprostatic lymph nodes. Poirier, Cunéo, and Marcille do not mention them. Deaver (1905) describes Walker's prostatic lymph node, and states that the latter's observations do not appear to have been confirmed by other investigators, who regard such lymphoid collections within the substance of the prostate as inflammatory in origin.

Wilson (1911) says that "islands of lymphoid tissue are frequently observed in the prostate. Weski, who has carefully studied these, notes their analogy to those found by Waldeyer in the dog's prostate. He mentions the possibility that these structures may be pathological, but believes, that on account of the human presence of similar lymph follicles in other glands, they may be considered physiological."

During my studies of pathological conditions of the prostate I have frequently found lymphatic nodes in the glandular portions of the prostate in both normal and pathological conditions of this organ. In some instances a marked hyperplasia with formation of germ centers was observed. At the suggestion of Professor Warthin, who had made similar observations, in his diagnostic examinations of prostatic material, and because of the paucity of recorded observations in the literature of such conditions affecting the lymph nodes of the prostate, and the general vagueness as to their occurrence and significance, I made a study of a series of 222 prostates obtained by operation and autopsy in the pathological laboratory of the University of Michigan, with special reference to the occurrence of hyperplasia of the rudimentary lymph nodes within the glandular portions of the prostate.

Preparation. The material was fixed in ten per cent formalin solution and imbedded in paraffin. Blocks were taken from all parts of the gland, usually eight to ten in number, and representing all lobes. Sections were made from these at different levels, and in some instances serial sections. The sections were stained with hæmalum and eosin, Van Gieson's stain, Weigert's elastic-fiber stain, Mallory's reticulum stain, and Unna's method for the staining of collagen.

The normal rudimentary lymph nodes of the prostate, as found in all normal adult human cases, consist of small aggregations of small lymphocytes slightly more crowded at the periphery than at the center, but not possessing any well-defined germ-center. The



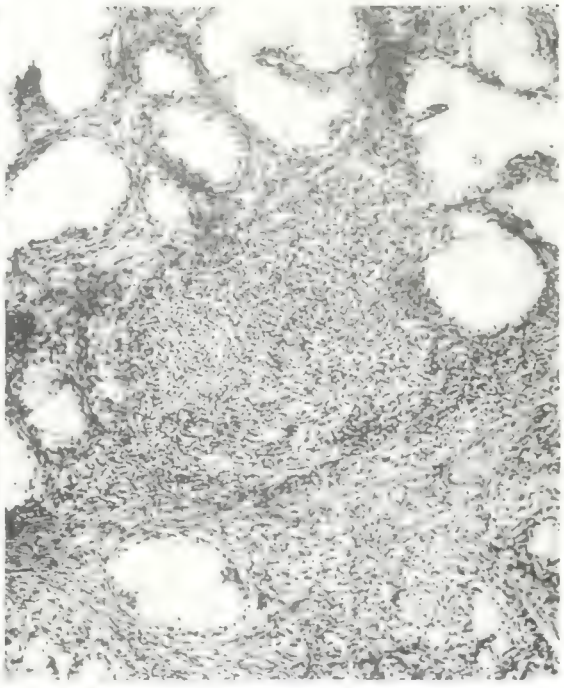


Fig. 1. Prostate from boy 14 years old, thymico-lymphatic constitution; death from tetanus. Hyperplastic rudimentary lymph nodes are present around the prostatic ducts.

urination, partial retention, and cloudy urine for one year. marked hyperplasia of rudimentary lymph nodes.

periphery is fairly distinct from the surrounding tissue, but without any definite capsule and irregular in outline. The collections of lymphocytes lie in a fine reticulum, and are disposed about a small terminal blood vessel. They are usually located just beneath the epithelium of the larger glandular acini and of the ducts. They are not large enough to be seen with the naked eye either in the unfixed prostate or in the stained sections.

The hyperplastic nodes vary in size from 0.15 millimeter to 0.5 millimeter, or larger, in diameter, so that they can be seen with the naked eye in stained sections. They are usually a little larger than the solitary nodes of the intestine. They are usually round or oval in shape, and are rather clearly distinct from the surrounding tissue. There is a definite formation of fine reticular network with lymph and blood vessels. The larger ones may be surrounded by dilated blood vessels and lymph vessels, especially the latter which are generally filled with lymphocytes. Well-defined germ centers may be found in the largest ones. Stellate or oval lymphoblasts occur in the centers, but the number of cells in the central portion is scant as compared with the germ centers of the solitary follicles of the gastro-intestinal tract.

The number of hyperplastic nodes in any given prostate varies much; some sections may contain several, while the search of many sections may fail to reveal any. They usually increase in number toward the outlets of the excretory ducts and the urethra. They occur also in the fibromuscular capsule of the organ.

The hyperplastic nodes contain few or no elastic fibers. These usually disappear at the periphery of the node, as do the muscle and connective-tissue fibers. When the node is situated near a glandular acinus, there is usually a thin layer of muscular connective tissue between it and the epithelium of the acinus.

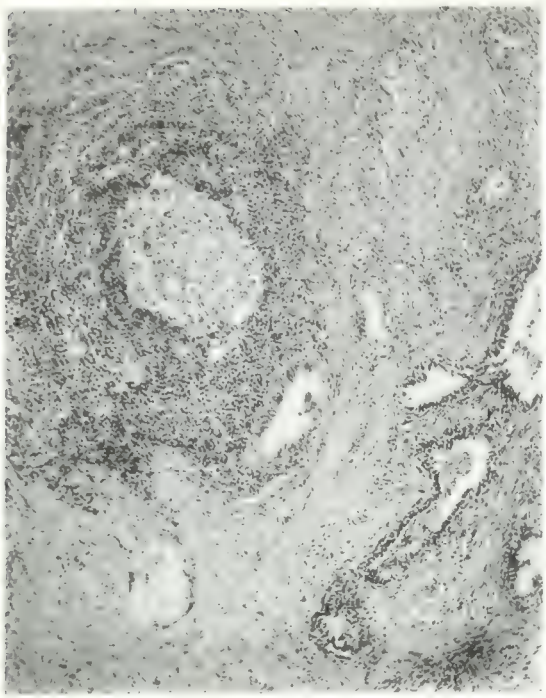


Fig. 3. Section from same prostate as in Figure 2, showing hyperplastic lymph follicle with well-developed germinal center.

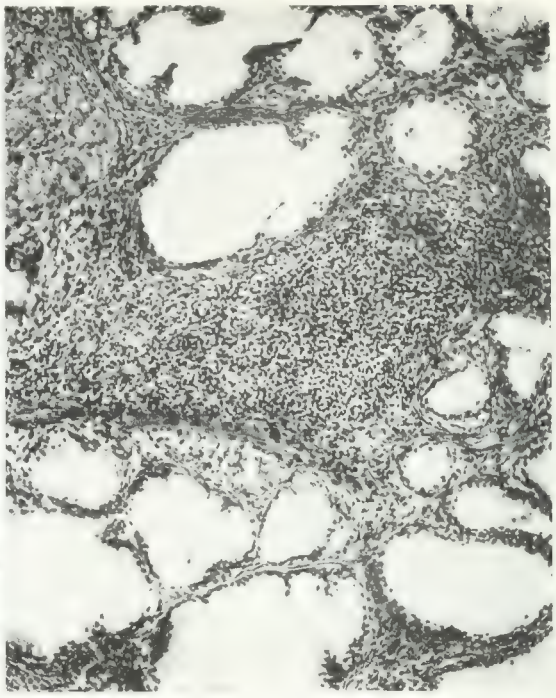


Fig. 4. Hyperplastic rudimentary lymph follicle in glandular portion of prostate showing marked glandular hyperplasia and cystic dilatation of glands. Patient 59 years old; had had prostatic symptoms for 5 years.

From inflammatory infiltrations the rudimentary lymph nodes are easily distinguished by the uniform character of the cells, their arrangement, the demonstration of the endothelium of the lymphatic vessels and the fibers of the reticulum. When there is a germinative center in the node, there is, of course, no difficulty.

In an examination of 222 prostates, hyperplasia of the rudimentary lymph nodes was found in 31 cases, as follows:

Pathological condition	Number of cases	Hyperplasia of lymph nodes
Lymphatic constitution	1	1
Lymphocytoma	1	1
Myelæmia	1	1
Normal prostate	48	0
Acute prostatitis	43	1
Chronic hyperplastic prostatitis	57	18
Atrophic prostate	23	1
Tuberculosis of prostate	2	1
Syphilis of prostate	1	0
Benign neoplasm (adenoma)	2	0
Secondary sarcoma	1	1
Carcinoma	42	6
Total	222	31

Well-developed germ centers of large size were found in five cases, in one case each of hyperplastic prostatitis, atrophy of prostate, lymphatic constitution, and prostatic tuberculosis and carcinoma. According to the table it will be seen that hyperplasia of the prostatic lymphoid tissue occurs most frequently in association with chronic hyperplastic inflammation and in cancer of the prostate. In the hyperplastic prostate, therefore, it was found in about one-third of the cases. The lymphoid hyperplasia is undoubtedly directly associated with the inflammatory process, as is the case in chronic inflammations of other organs, such as the cervix of the uterus, endometrium, tubes, and kidneys, in which the rudimentary lymph nodes are normally as small as those in the prostate, but in conditions of chronic inflammations often become as large, or even much larger, than the solitary follicles of the intestinal tract. Particularly in the kidney of chronic pyelonephritis, the apparent new-

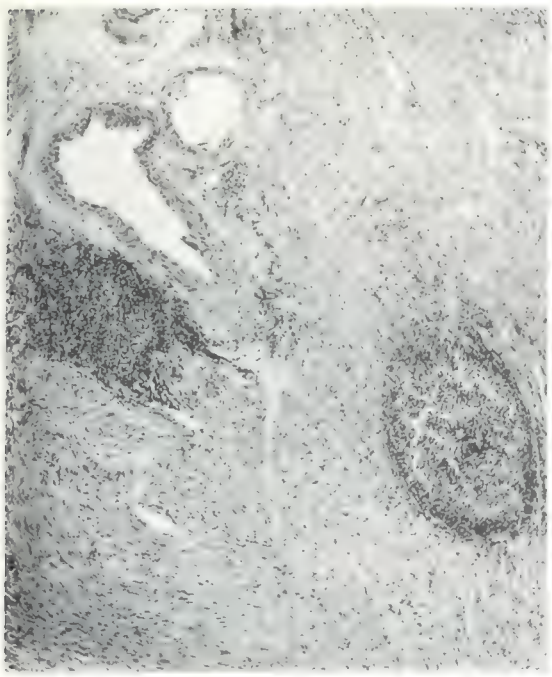


Fig. 5. Hyperplastic rudimentary lymph follicles in outer muscular coat of prostate, from patient 69 years old, who had had prostatic symptoms for 5 years. Chronic hyperplastic prostatitis.

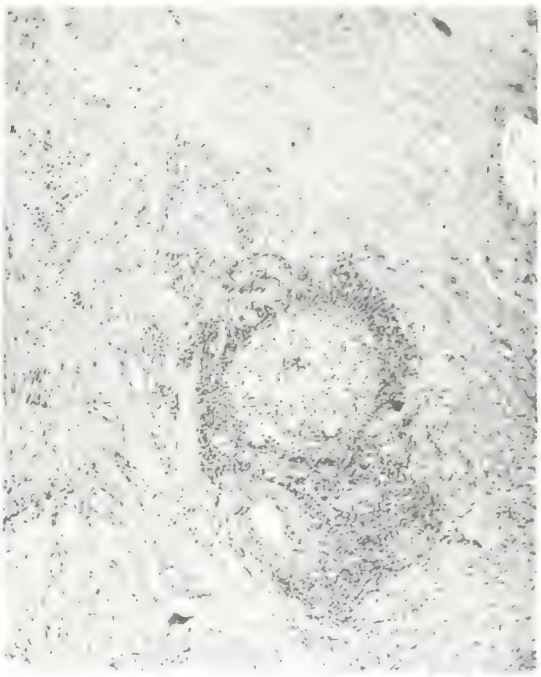


Fig. [illegible] Hyperplastic rudimentary lymph follicles in outer muscular coat of prostate. Case of scirrhous carcinoma of prostate. Patient 79 years old; symptoms of prostatic [illegible] for 2 years. In the fibromuscular tissue about the lymph follicle, there are infiltrations of small round carcinoma cells.

formation of lymphoid follicles with germinal centers is often very striking. While some of them may be new-formations of lymphoid centers, the majority are probably hyperplasias of pre-existing rudimentary follicles. Hyperplasia of the latter occurs in practically all parts of the body in prolonged local chronic inflammations. Therefore, the hyperplastic rudimentary lymph follicles of the prostate seen in chronic prostatitis with glandular and interstitial hyperplasia are the direct result of the chronic infection and inflammation (inflammatory hyperplasia).

Likewise, in the carcinoma cases the frequent hyperplasia of these primitive lymphoid follicles is either the result of the chronic inflammation preceding the development of the carcinoma, or of an inflammatory process following the growth of the latter. In fact, all of the cases of carcinoma showed both glandular hyperplasia and increase of stroma. In one case of scirrhous adenocarcinoma the hyperplastic lymph nodes contained carcinoma cells, and serial sections showed an invasion through the gland by way of the lymphatics. A similar extension was seen in the one case of secondary sarcoma. Hæmosiderin was found in the lymphoid follicles in several of the cases of chronic prostatitis. Both of these findings show that these rudimentary lymph follicles functionate as in other parts of the body.

The one case of lymphatic constitution was from a boy fourteen years of age, dying of tetanus. He presented the usual complex of hyperplastic thymus, hypoplastic adrenals, and hyperplasia of the lymphoid tissue throughout the entire body, particularly in the gastro-intestinal tract. In the prostate, lymph follicles with germ centers were found scattered through the gland, large enough to be seen with the naked eye in the stained sections. They showed a special localization around the mouths of the excretory and ejaculatory ducts, completely surrounding these with a ring of lymphoid tissue.

Inasmuch as the lymphoid hyperplasia in the lymphatic constitution is a generalized process it would be expected that the rudimentary lymphoid tissue of the prostate would become hyperplastic in other generalized diseases of the lymphoid system, such as Hodgkin's disease, lymphosarcoma, aleukæmic and leukæmic lymphocytoma, leukæmia, pernicious anæmia, etc. In a case of generalized lymphocytoma with prominent lesions in the intestinal tract and salivary glands reported by E. E. Butterfield from this laboratory, in 1907, no lymphoid collections were found in the prostate. I have examined the sections of prostate in eighty autopsy cases in this laboratory, including cases of myelæmia, Hodgkin's, lymphosarcoma, pernicious anæmia, etc., but in only two cases, one of lymphocytoma and one of myelæmia, did the sections show any hyperplasia of the prostatic rudimentary lymph nodes. Professor Warthin has, however, in his material several cases of leukæmic infiltrations of the prostate which he will report later.

CONCLUSIONS

Small, primitive, or rudimentary lymph nodes occur normally throughout the prostate in the form of very small aggregations of lymphocytes located beneath the glandular and duct epithelium, most marked toward the outlets of the ducts. They are analogous to the rudimentary lymph nodes found in other organs, such as the liver, kidneys, uterus, etc.

Hyperplasia of these rudimentary lymph nodes of the prostate occurs chiefly in chronic hyperplastic prostatitis and in primary carcinoma of the prostate. In both conditions, the hyperplasia is essentially an inflammatory one due to chronic infection, or irritation, and possesses the same significance that such hyperplasias have in other parts of the body.

In the absence of chronic inflammation, a hyperplasia of the primitive lymph nodes of the prostate occurs in the lymphatic constitution, and may be found also in other generalized diseases of the lymphoid system, as Hodgkin's disease, lymphocytoma, and leukæmia.

In both the inflammatory and non-inflammatory hyperplasias well-developed germinal centers may be produced in the hyperplastic node. Other evidences of functional activity by these hyperplastic nodes are shown in the metastasis of pigment, tubercle-bacilli, and carcinoma cells to them.

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SYNCYTIOMA (ATYPICAL CHORIOMA) OF THE UTERUS TERMINATED BY ACUTE PERITONITIS

BY HENRY L. MELENEY, M.D.

CHORIOMA, the interesting tumor developing from the ectodermal elements of the chorion of the fœtus, is known to vary widely both in clinical course and in gross and microscopical appearance. In many cases it is an extremely malignant tumor, causing extensive local destruction of tissue and metastasizing widely by way of the blood stream. In other cases, with the early clinical and microscopical appearance much the same, it is cured by curettage, or else spontaneously retrogresses, occasionally even after the appearance of metastasis in the lungs or vagina.

Even the earliest writers on chorioma, especially Marchand (1), recognized the great variation in the course taken by the tumor and the difficulty of determining from the histological examination, either of curettings or of specimens removed at operation, what the ultimate outcome would be. More recently however, attempts have been made to classify the various forms of the tumor (Schmauch, 2; Ewing, 3; von Velits, 4; R. Meyer, 5), so as to determine, if possible, the criteria by which the surgeon could decide whether hysterectomy were required for a complete cure or whether curettage would suffice. Such a classification has not as yet been relied upon to any great extent, in determining surgical procedure, and is considered unreliable by some of the recent writers on the subject (Goff, 6). However, it is probably true that some definite law determines the benignancy or malignancy of all tumors, and it may be that eventually histological criteria will be found on which a differentiation of the benign from the malignant chorioma can be made.

The elements which may enter into the formation of the chorioma are the cells of the two ectodermal layers of the chorionic villus, namely Langhans cells and syncytium. Of these the Langhans cells seem to be the element which has the power of destructive invasion and metastasis, while the syncytium apparently plays the rôle merely of an accomplice. Not all choriomata contain both elements, but they all contain syncytium. Some of those which contain both elements are benign in their course, some are malignant; but all of those containing only syncytium are apparently benign.

The syncytium as it occurs in the tumors is often not a typical syncytium, but takes the form of large cells of various shapes, with deeply staining acidophilic cytoplasm and a single nucleus varying in size, shape, and staining property. Occasionally one cell contains two or three nuclei. That these cells are really derived from the syncytium is evident from their similarity to the true syncytial masses which are often present in the same tumor. The extraordinary thing about these cells is their apparent power of wandering from their original site through the tissue of the uterus, especially into the myometrium, where they are found singly or in groups between muscle cells, in the connective tissue, and especially in relation to blood vessels. Often they even bulge into the lumen of a vessel, and it is probably their special tendency to do this that leads to the frequent metastasis of the tumor by way of the blood stream.

One of the striking facts connected with the benign choriomata is the frequency with which acute infection of the uterus accompanies the condition, often leading to a terminal septicæmia or peritonitis. This feature is so common that some writers have called the condition "syncytial endometritis." The persistence in the recently pregnant uterus of soft, vascular, partly disintegrating tissue seems to provide an exceptional culture medium for bacteria which are accidentally present. The uterine wall, due to the presence of the tumor, remains abnormally vascular,

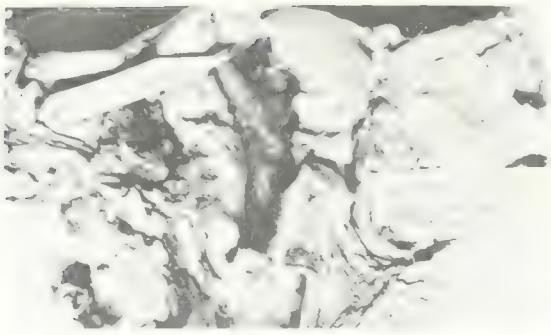

Fig. 1. Uterus and adnexa showing syncytioma in right cornu of uterine cavity. Posterior view.

absorption from the mucous surface is great, and the way is open for the formation of septic thrombi in the uterine veins or for extension of the infection to the peritoneal surface.

The following case is reported to illustrate the septic termination which may occur in the presence of an insignificant and apparently regressing chorioma of the syncytial type.

A Chinese woman, age 35, was admitted to the Sleeper Davis Memorial Hospital, Peking, complaining of palpitation of the heart and weakness. Family and past history were irrelevant. She had been married at 18 years of age and had had six children, the last one born 3½ years ago. One year before admission she had a miscarriage, at which time she had a severe uterine hæmorrhage, which recurred frequently thereafter until the date of admission. Physical examination showed a poorly nourished and very anæmic woman, with pulsating jugular veins, a systolic heart murmur heard over the precordium and over the left chest posteriorly, and a few moist râles at the bases of the lungs. Abdominal and vaginal examinations were negative.

While confined to bed in the hospital, uterine hæmorrhage recurred without apparent cause. Temperature varied between normal and 100.8° F. for the first 3 weeks in the hospital. At the end of this time there was only a scant pink vaginal discharge. She then had a sudden rise of temperature to 104° F., after which her illness took on a septic course, with temperature remaining above 101° F. Eight days after the rise in temperature she complained of abdominal distention, but had no abdominal pain. She sank rapidly and died that night. The final clinical diagnosis was septicæmia.

Necropsy. This was performed at the Peking Union Medical College 18 hours after death. Externally the body showed extreme pallor and considerable emaciation. There were no petechial hæmorrhages in the skin or mucous membranes. The thyroid gland was diffusely enlarged (a condition very common in Peking). The abdomen was distended and tympanitic. There was a slight pink vaginal discharge. The abdominal cavity contained about 500 cubic centimeters of gray, purulent fluid, and the coils of intestine were bound together by fibrinous adhesions. Culture of the peritoneal fluid and heart's blood yielded hæmolytic streptococcus. The uterus was slightly enlarged, measuring 8 centimeters in length by 7 centimeters across the fundus, and on being opened was found to have a rather large cavity containing a little purulent fluid similar to that in the peritoneal cavity. Smear from this fluid showed pus cells and many gram-positive cocci in pairs and short chains. A culture was not made. In the uterine mucosa there were many small hæmorrhagic areas. Otherwise the endometrium was pale, but was neither swollen nor soft. The myometrium was pale, firm, and not swollen. In the right cornu of the uterine cavity, just mesial to the point of entrance of the right fallopian tube, was a flat, round, black and gray mass 1.5 centimeters in diameter, firmly attached by a broad base to the uterine mucosa, of very soft consistency, and with a gray, apparently ulcerated surface (Fig. 1). In the cervix were several small cysts containing clear fluid. In the uterine veins about the cervix and near the right fundus were several thrombi, apparently sterile. The lumen of both fallopian tubes could be demonstrated grossly only in the outer third. Their fimbriated ends were red and œdematous. The left ovary measured 5 by 1.5 centimeters, the right 4 by 1.5 centimeters. They were both flattened out behind the broad ligament. They each contained two small corpora lutea. The lungs were œdematous and congested posteriorly, but showed no gross consolidation nor evidence of

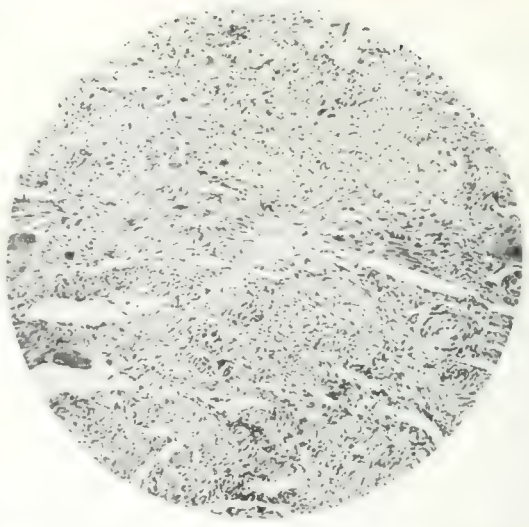

Fig. 2. Syncytioma. Syncytial cells in tumor near surface of uterine mucosa. (X 50.)

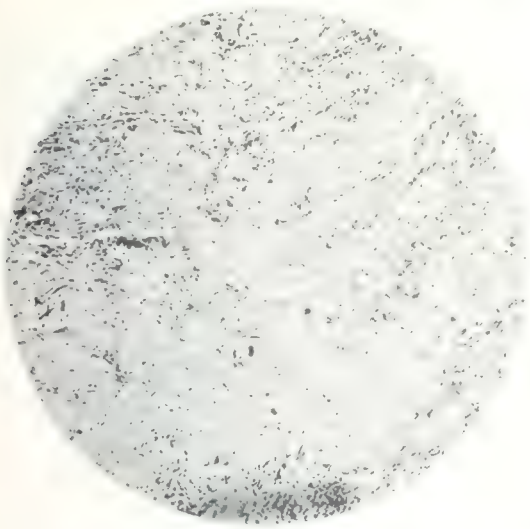

Fig. 3. Syncytioma. Syncytial cells in myometrium beneath tumor. (X 50.)

Fig. 4. Syncytioma. Another group of tumor cells in the myometrium. (X

embolus. The spleen weighed 175 grams, was considerably enlarged and flabby and, on section, bright red and very soft. The kidneys were slightly enlarged, pale and flabby, but otherwise grossly normal. At the hilum of the left kidney the renal vein contained a recent thrombus which completely filled it and extended into all the large branches of the vein. It did not, however, extend beyond the region of the kidney pelvis either toward the vena cava or into the left ovarian vein. The thyroid gland was enlarged and lobular and on section consisted of colloid glandular tissue and several large colloid cysts. The heart, aorta, liver, and other visceral organs were grossly normal. The head was not opened.

Microscopically the mass in the uterine cavity consisted of a thickening of the stroma of the uterine mucosa with entire absence of lining epithelium or glands, but containing scattered masses of smooth muscle. There were a few large blood vessels

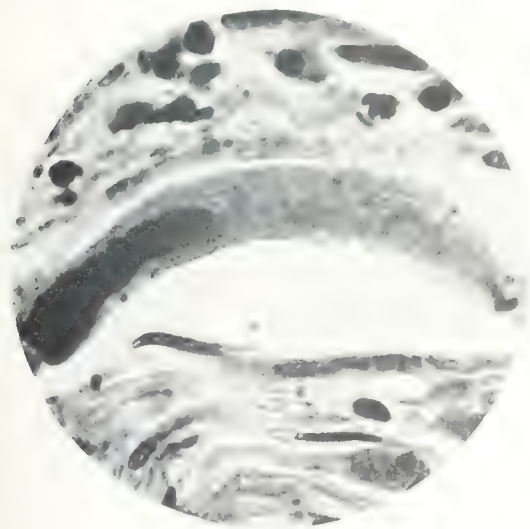

Fig. 5. Syncytioma. Syncytial cell conformed to the shape of surrounding smooth muscle cells. (X

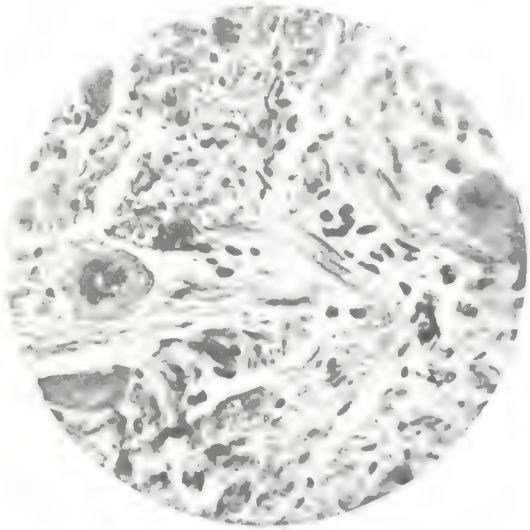

Fig. 6. Syncytioma. Syncytial cells of shape and of various

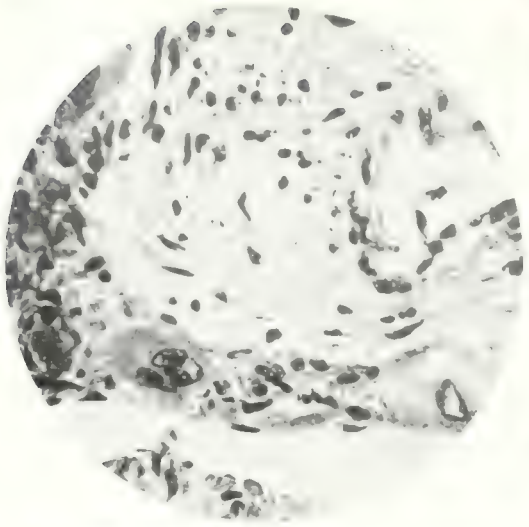

Fig. 7. Syncytioma. Syncytial cells in the wall of an artery in the myometrium. (X 250.)

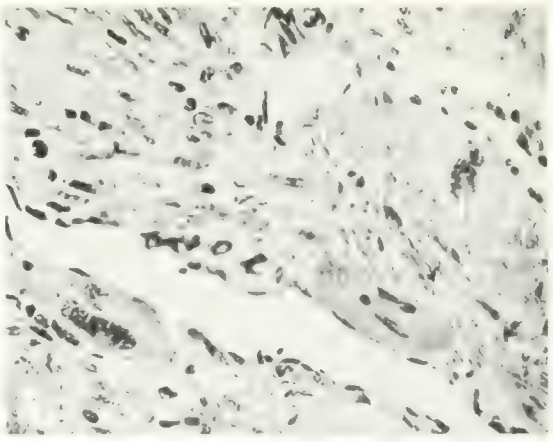

Fig. 8. Syncytioma. Syncytial cells abutting on a blood sinus in the uterine wall. (X 300.)

and very many small ones, especially capillary vessels dilated into sinuses. There was considerable infiltration by lymphocytes and a few polymorphonuclear leucocytes and, near the surface, many cocci which were not decolorized by the Gram stain. Scattered through this tissue were many huge cells of all shapes with one or rarely two nuclei of varied size, shape, and density, and with deeply staining, slightly granular cytoplasm. They sometimes reached one hundred micra in the longest diameter. These cells occurred both in groups and scattered singly through the tissue (Figs. 2, 3, and 4). They appeared to be easily distorted by the tissue in which they lay, conforming their shape to the requirements of the surrounding structures. Thus among the smooth muscle cells they often simulated huge cells of that type (Fig. 5), and about blood vessels they shaped themselves to fit the lumen or coats of the vessel wall (Figs. 6 and 7). They were especially numerous about blood vessels, sometimes abutting directly on the vessel lumen to the apparent exclusion of the endothelial cells (Fig. 8). These cells were often found close together, but were not seen to be confluent as is a true syncytium. In the myometrium beneath the tumor these huge cells also occurred in a few large groups as well as scattered singly in the smooth muscle or connective tissue or about blood vessels. They were present, however, only in the more superficial portion of the myometrium directly beneath the tumor, and were not found in any other part of the uterus than that immediately adjacent to the tumor.

The myometrium was normal except for the presence of the tumor cells. Its blood vessels contained no thrombi. Sections from the remainder of the uterus showed loss of all of the surface epithelium and of some of the uterine glands. There was considerable infiltration of the superficial tissue by leucocytes, mostly mononuclear in type. There were also many gram-positive cocci on the surface and in the tissue just beneath the surface.

The fallopian tubes microscopically showed nothing abnormal, each having a wide lumen near the outer end and a very small lumen near the uterus. About the right tube, however, several vessels, whether veins or lymphatics it was impossible to determine, were packed with polymorphonuclear leucocytes and degenerated cellular material. This was present in sections both from near the uterus and from near the fimbriated end of the tube and may have been the avenue of extension of the acute infection from the uterus to the blood stream and peritoneum. One small vein near the left tube contained a sterile thrombus. The other vessels were normal. The ovaries each contained several rather recent corpora albicantia, but none in the luteal stage, nor were there any lutein cysts of the type sometimes present in cases of chorioma. There were active ovarian follicles in various stages of development.

The other organs showed only the changes incidental to a long illness terminated by an acute general infection. The thrombi in the uterine and renal veins were all sterile.

The points of special interest in this case are, first, the insignificant and retrogressing appearance of the tumor; second, its location close to the entrance of the right fallopian tube; and, third, the finding, microscopically, of pus in vessels leading from this region toward the peritoneal cavity and the general circulation. Without the presence of the infection which terminated the case, there is

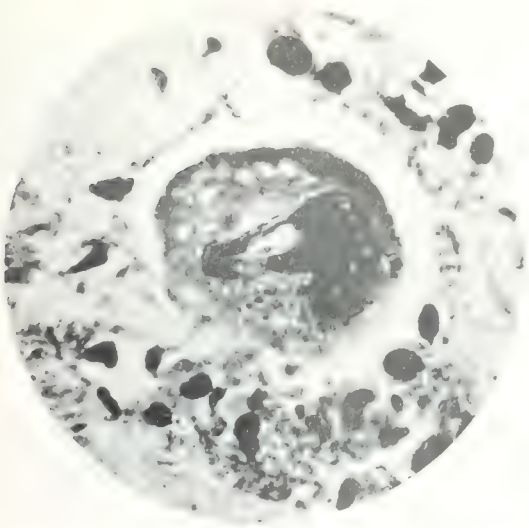

Fig. 9. Syncytioma. Detail of syncytial cell. X 650.

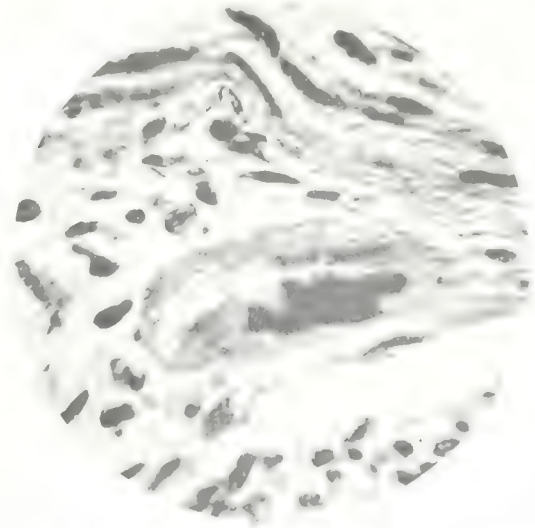

Fig. 10. Syncytioma. [illegible] cell. X [illegible]

little doubt but that the tumor would have ultimately disappeared entirely. While still present, however, it was probably at least a portal of entry, through its soft necrotic surface, for the extension of the infection into the uterine wall. Without the presence of the tumor the infection of the uterine cavity might have been self-limited.

The source of the uterine infection is not clear, but, with the parturient condition of the organ prolonged by the presence of a portion of the embryo, a condition existed which, especially in an ignorant person without medical attention, invited the introduction and growth of pathogenic organisms which may have been present in the vagina.

The course of the disease in this case is the same as that which occurs in a considerable proportion of cases of syncytioma. In Schmauch's summary of 206 cases of chorioma (2), seven died of sepsis, and in all these the tumor was benign. In some cases of this type as in Hammerschlag's fourth case (7), there is no definite tumor in uterus, but the mucosa and muscularis are infiltrated by syncytial cells.

This case illustrates the importance of establishing an early diagnosis of the cause of persistent uterine bleeding after abortion or parturition. It also illustrates the necessity of removing all possible tumor tissue in the presence of a chorioma, to avoid an unfavorable outcome from extension of a possible infection through the susceptible tumor tissue.

SUMMARY

1. A case of atypical chorioma is reported, in which the necropsy showed a small tumor in the right cornu of the uterine cavity, acute infection of the endometrium extending through vessels about the right fallopian tube, acute diffuse peritonitis, and hæmolytic streptococcus bacteriæmia.

2. The tumor consisted only of syncytial cells lying singly and in clumps in the swollen stroma of the uterine mucosa and in the superficial portion of the myometrium.

3. The case illustrates the importance of early determination of the cause of uterine bleeding, not only in order to deal properly with the tumor itself, but also to avoid a termination by acute general infection.

I wish to express [illegible] Dr. Emma L. Matter, the Women's Univ. Med. [illegible] College, Philadelphia, for permitting me to [illegible] report this case.

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MECKEL'S DIVERTICULUM[1]

By ALEXIUS McGLANNAN, M.D., F.A.C.S., Baltimore

THE relative frequency of the occurrence of Meckel's diverticulum is given by most authorities as between 1 and 2 per cent. Albers[2] puts it at 0.1 per cent. Coley and Fortune[3] say: "In 18,000 autopsy examinations of subjects who died of other trouble 15 cases of Meckel's diverticulum were found."

The true frequency is probably between these extremes and the wide discrepancy may be explained by Mitchell's observation[4] that its order of occurrence is quite inconstant; thus, in 200 successive autopsies not one case was found, and then again its presence was noted in two successive cases.

Whatever difference of opinion may exist among anatomists as to the frequency of its occurrence, there is no doubt among surgeons as to the possibilities for danger existing in this fœtal remnant.

Intussusception may be limited to an invagination of the diverticulum itself, or this invagination may be the starting point for a complicated infolding of the bowel, extending well into the colon. With an umbilical fistula the intussusception may consist of invaginated bowel from above prolapsed through the fistula, or the infolding may be the result of a prolapse of the diverticulum through the fistula, dragging the ileum after it. In the former event fæces will be discharged from the apex of the protrusion, while in the latter the fæces will come from the groove behind the apex.[5]

Volvulus of the diverticulum alone, or with this structure as a starting point, a twist involving a loop of small intestine may lead to gangrene of the bowel. Acute inflammation of the diverticulum is likely to end in perforation and peritonitis. When attached to the umbilical scar the resulting band becomes the cause of certain cases of intestinal obstruction. When unattached, the free end may become adherent to the mesentery, to the intestine, or to the parietal peritoneum, and produce obstruction, either as a constricting band about the bowel, or by a kinking as a result of traction. If the diverticulum is long, and especially when the free end is knoblike, the tip is likely to loop itself around the remainder of the structure in such a way that a knot is formed. A segment of bowel falling into this knot will soon become obstructed and strangulated (Fig. 8).[6]

Meckel's diverticulum may be the sole content of a hernia (Littré's hernia), or it may be present with other portions of the bowel. The diverticulum has been found in umbilical, inguinal, and femoral hernias, strangulated or otherwise.

Alterations in the character of the attachment of the diverticulum to the intestine and to the umbilicus lead to the formation of various types of cystic tumors of the abdomen. A volvulus, in which the twisting is not rapid or tight enough to cause gangrene, may end in a cystic dilatation with a flat pedicle.[7]

[2] Quoted by Bartle. Ann. Surg., xl, 545.
Ann. Surg., 1904, lxxix, 570.
J. Anat. & Physiology, xxxvii, 63.

Fig. 1. Acute diverticulitis. The gangrenous diverticulum is surrounded by an adherent mass of omentum. Note the narrow opening at the base of the diverticulum.

Fig. 2. Meckel's diverticulum in the sac of a femoral hernia.

[5] Corner, Ann. Surg., xxxv, 690.

[6] Treves, Intestinal Obstruction, p. 50; Eisendrath. Ann. Surg., I, 1278.

[7] Cullen. The Umbilicus, p. 170.

[1] Read before the Southern Surgical Association, Pinehurst, North Carolina, December, 1921.

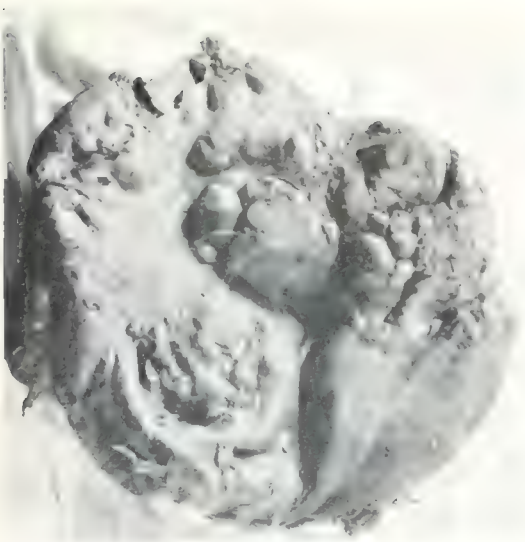

Fig. 3. Cystic malignant tumor of Meckel's diverticulum. Outside view.

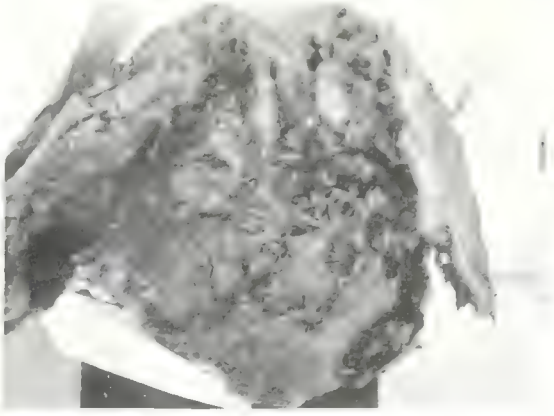

Fig. 4. [illegible] diverticulum. Inside view.

Benign and malignant tumors may develop in the wall of the diverticulum.

These menacing characteristics of Meckel's diverticulum amply justify Porter's advice that whenever one is observed during the course of an operation it should be removed, if the condition of the patient will permit the additional manipulation.[1]

The following report gives my experience with Meckel's diverticulum. The three cases were observed in the course of nearly 1400 intraperitoneal operations performed during the past 15 years.

CASE 1. Acute diverticulitis.

S. No. 3747. The patient, a white female, age 18, was sent to the Mercy Hospital by Dr. Wilkinson, on account of recurrent attacks of abdominal pain. The previous attacks had been diagnosed acute appendicitis. On admission the patient had colic-like pain, with tenderness, muscle spasm, and rigidity in the right lower quadrant. On deep palpation a mass was felt at the edge of the rectus muscle, about 2 inches below the level of the umbilicus. The mass slipped under the fingers, and this movement caused pain. A diagnosis was made of appendicitis with omental adhesions.

Operation, October 2, 1917. McGlannan. Ether anæsthesia. The abdomen was opened by a McBurney incision. The lower portion of the appendix was found œdematous and the mesentery thickened. The appendix was removed. The mass at the [illegible] brought out through the wound. It proved to be an acute inflamed gangrenous Meckel's diverticulum surrounded by adherent omentum. The attachment of the diverticulum to the convex border of the ileum was very small, not more than 3 millimeters in diameter. It was situated about 40 centimeters from the ileocæcal valve. The attachment was divided between clamps, the stump ligated, disinfected, and turned in by Lembert sutures. The healthy omentum was clamped around the mass, which was removed with the diverticulum. The abdomen was closed without drainage and the patient recovered.

The specimen [illegible] diverticulum and the adherent mass of omentum. The wall of the diverticulum was soft and pulpy. The mucous membrane and musculature were almost entirely destroyed, leaving intact only the peritoneal coat.

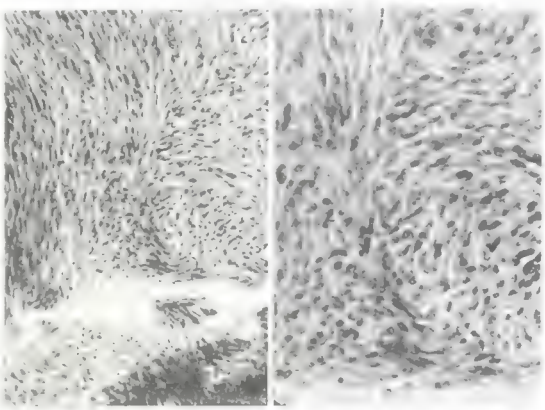

Fig. [illegible] diverticulum. [illegible]

[1] J. Am. M. Ass., [illegible]

Fig. 7. Strangulated intestine caught in the loop of a Meckel's diverticulum. (*Cullen.*)

Fig. 8. Diagram illustrating Figure 7. (*Cullen.*)

While cases of acute diverticulitis are not common several have been reported. Practically all of them have been diagnosed appendicitis before operation. In some of the earlier reports an attempt is made to outline symptoms characteristic of disease of Meckel's diverticulum. At the present time, however, the opinion of those best fitted to judge is that unless some anomaly of the umbilicus is present, or is clearly indicated in the past history, it is impossible to distinguish between diverticulitis and appendicitis. In operating for acute appendicitis when the appearance of the appendix does not explain the clinical symptoms, a search should be made for a possible acute Meckel's diverticulitis.

Coincident acute appendicitis and perforation of Meckel's diverticulum has been reported.[1] Lehman[2] points out the similarity of etiological factors in acute diverticulitis and acute appendicitis. He calls special attention to the importance of a narrowing of the outlet of the diverticulum and the consequent stasis within its lumen, as a cause for the onset of an inflammatory process. The opening of the diverticulum into the bowel is generally wide. This fact may explain the relative infrequency of acute inflammation as compared with other lesions of the diverticulum.

[1] Pearce, U. S. Naval Bull., 1919, July, 5.
[2] Wien. klin. Wchnschr., 1915, xxviii, 584.

Case 2. Femoral hernia containing Meckel's diverticulum.

S. No. 15784. The patient, a white man, age 40, was sent to the Mercy Hospital by Dr. J. C. Lawson. He had a right femoral hernia which was only partly reducible. It had been present 3 years. The patient's occupation required him to take long rides on horseback over rough country and he attributed the hernia to this exertion. A truss had been worn, but proved unsatisfactory and the hernia became painful when he took a long ride. There had never been any symptoms of strangulation, or of inflammation of the hernia.

Operation, March 4, 1920. McGlannan. Procaine infiltration. The hernia was exposed by an oblique incision. The bowel was adherent to the sac, and when separated it was found to be a blind pouch adherent by its free end to the sac. Traction on the pouch brought out a loop of small intestine. The pouch proved a diverticulum arising from the convex border of the small intestine and had a thin mesentery running up its side (Fig. 2). The diverticulum was clamped at its junction to the ileum and removed. The intestinal wall was closed with catgut and linen sutures. The sac was excised after transfixion and ligation of its neck. The femoral canal was closed with a pursestring suture and the skin with interrupted stitches. The patient recovered without any complications.

The diverticulum was 2⅛ inches long and ⅜ inch in diameter at its base. The tip had one small nodular projection. The mucous membrane and other coats were well developed and intact. Microscopically it showed all the structures found in the wall of the small intestine including Lieberkuehn's glands and a Peyer's patch.

Meckel's diverticulum has often been found as the contents of a hernia, either alone or with other structures, including the cæcum and appendix. In about three-fourths of the reported cases the diverticulum is the sole occupant of the hernial sac, as it was in the case reported by Littré[1] which gave his name to this type of hernia.

The proportion of inguinal to femoral hernias containing the diverticulum was about three to one in Pabst's collection of [illegible] cases. The total number of strangulated hernias was 54, of which 35 contained the diverticulum alone. Strangulation occurred in 17 of 24 femoral and in 35 of 66 inguinal hernias. When the diverticulum was the sole content of the strangulated hernia, the local signs were marked while the symptoms of intestinal obstruction were mild or absent.

Case 3. Large cyst of Meckel's diverticulum, sarcoma of cyst wall.

S. 4130. The patient, a white man, age 50, was sent to the Mercy Hospital by Dr. McAvoy, on account of discomfort in his abdomen, with progressive loss of weight and vigor. He had a large nodular tumor occupying the lower hemisphere of the abdomen. The tumor was movable through a rather long, up-and-down excursion. There was some pain in the right lower quadrant when the mass was manipulated. After study a diagnosis was made of tumor of a relaxed transverse colon or of the omentum.

Operation, November 3, 1917. McGlannan. Ether anæsthesia. A long incision was made through the inner border of the right rectus. When the peritoneum was opened, a dark purple cystic mass was exposed, filling the greater part of the abdominal cavity. There was a number of very large veins in the wall of the cyst and the omentum was adherent at several points on its circumference. At the upper pole of the cyst there was a loop of small intestine, apparently adherent to the growth. In exploring the attachments of the cyst, it was ruptured and a large quantity of dark brown, bloody fluid was discharged. It was then lifted out of the abdomen and was found to be attached by a short pedicle to the small intestine about 14 inches from the ileocæcal valve. The wall of the cyst was continuous with the wall of the intestine through a pedicle about 2 inches long which came off from the convex border of the bowel. The tumor was recognized as a development from a Meckel diverticulum.

This pedicle was clamped and divided and the intestinal wall closed with catgut and linen sutures.

[illegible] given salt solution subcutaneously and external [illegible] examination was refused.

The tumor (Fig. 3) has the shape of a flattened [illegible] short diameter. The wall is thin in most pla[illegible] [illegible] a number of knob-like, yellowish white areas which are thick and firm. These areas vary in diameter from ¼ to 2 inches. On the inside of the cyst there is a rough shaggy coat which in places has disappeared leaving only a thin translucent peritoneal [illegible]. Microscopic [illegible] block taken from one of the knobby areas shows this tissue to be [illegible]

Cysts developed from Meckel's diverticulum are extremely rare. As far as I have been able to search the literature, the only cyst of a diverticulum as large as this one that has ever been reported, is Black's case,[3] reported to this society at the Baltimore meeting. In Black's case the diverticulum grew from the sigmoid.

Symmers[4] reports a case of malignant myoma associated with Meckel's diverticulum and refers to Fried's report of a fibromyosarcoma and to Kaufmann's report of a spindle-cell sarcoma, both tumors having their origin in the wall of a Meckel's diverticulum.

Through the courtesy of Dr. George A. Stewart, I am able to add the following case:

Case 4. Intestinal obstruction due to snaring of a loop of small intestine in the knot of a true Meckel's diverticulum.

[illegible] The patient was a white man, age [illegible]. The history previous to the attack of obstruction was negative and there was no umbilical deformity or discharge. The onset of the attack occurred at 1 a. m. with nausea and vomiting, quickly followed by abdominal pain. His bowels moved once, but this did not give him any relief from his pain. Twelve hours after the onset his abdomen was [illegible] generally distended. At operation, the gangrenous loops were resected and a lateral [illegible]

[illegible] (Fig. [illegible]) shows [illegible] gangrenous small intestine, caught in the knot of the [illegible]

[1] Mem. de l'Acad. Sc., 1700, p. [illegible]

[2] Beitr. z. klin. Chir., 1912, lxxx, [illegible]

The mechanism of these knots was worked out by Pavise and others in 1845, and is illustrated in Treves' *Intestinal Obstruction*, p. 50.

Among congenital causes of intestinal obstruction Meckel's diverticulum is generally accepted as the one most frequently present. In the series of 276 cases which I studied in 1915,[1] there were 9 instances where the diverticulum was recognized as the cause of the obstruction. Six of the patients died and three recovered after operation. In one case the diverticulum was attached to the inner surface of the umbilicus by a cord; in the others it was free or had become adherent by its tip, or a cord, to the bowel or mesentery. The obstruction was caused by entanglement of a loop of intestine around the diverticulum, except in one case, where the adherent diverticulum kinked the bowel by traction. In none was there any umbilical deformity or discharge.

SOME EXPERIENCES WITH THE "MELTZER-LYON" TEST IN GALL-BLADDER DISEASE

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INTRODUCTION

THE "Meltzer-Lyon" test, as is well known, is a method proposed for the diagnosis and treatment of biliary pathology. It consists in the instillation of a strong solution of magnesium sulphate in the duodenum by means of a tube, with the hope that this will paralyze the sphincter of Oddi, that this paralysis of the sphincter will be followed by reflex contraction of the gall bladder, thus permitting the collection of specimens of common duct, gall-bladder and liver bile. It is based on the experimental evidence that 25 per cent magnesium sulphate applied to the intestinal mucosa of a dog causes relaxation of the musculature in that area (Meltzer, 29). Subsequent investigation would seem to show that a solution of magnesium sulphate in the duodenum will relax the common duct sphincter (28). The test is further based on the assumption, as yet unproven, that with relaxation of the sphincter of Oddi the gall bladder contracts (25, 29). This latter assumption of the law of contrary innervation is merely the application of a principle already recognized by physiologists and applicable to other parts of the body. The experiments of Doyon (9) and Freese (13) demonstrated the double innervation of the gall bladder, and although their experiments seemed to show that the muscle wall had but little contractile power, the above assumption is very tempting. However, the proof of this hypothesis is wanting.

The clinical performance of the test has been repeatedly described (Lyon, 23, 24, 25). It consists in the passage of a sterile tube into the first portion of the duodenum. The passage of the tube is aided by various manœuvres, the most helpful of which is elevation of the hips and keeping the patient on the right side once the tube has reached the stomach. Specimens of gastric and duodenal content are aspirated for study as encountered. When the tip lies in the duodenum a solution of magnesium sulphate varying in concentration from 20 to 40 per cent and in amount from 50 to 100 cubic centimeters is instilled, the tube pinched off for from 3 to 5 minutes, following which the duodenal content is secured by aspiration or syphonage. The first material recovered is chiefly the magnesium sulphate solution instilled, but this is soon followed by a yellowish fluid increasingly bile-stained. The first bile-colored fluid recovered is naturally the content of the common duct ("A" bile),[1]

[1] Lyon uses term A, B, and C bile to represent specimens of common duct, gall-bladder and liver bile respectively.

since, when the sphincter of Oddi is paralyzed by the action of magnesium sulphate the positive pressure in the duct forces its content into the duodenum. If later there is a sudden change to a dark brown bile ("B" bile), it is natural to suppose it is from the gall bladder, since if we admit the existence of the law of contrary innervation of gall-bladder and sphincter muscle, the gall-bladder content should now be forced out into the duodenum. The proof of the contention that gall-bladder bile is darker and more concentrated than liver and duct bile is now available in the evidence presented by Rous and McMasters (37) on the concentrating activity of the gall bladder. If no dark bile appears, one may conclude that obstruction or an obliterated gall bladder exists. After such dark bile has run for a time, the color of the bile grows lighter and lighter, and one may suppose that having exhausted the contents of both the common duct and the gall bladder, the bile coming forth is hepatic bile ("C" bile)[1], i.e., bile from the hepatic ducts and its finer tributaries. The specimens obtained must then be studied for their bacteriological, cytological, and chemical content.

Thus far the test does not seem difficult of performance and, indeed, it may not be. But there are several pitfalls. One of these is the difficulty of being sure that the tip of the tube is in the correct portion of the duodenum, or even in the duodenum. In our work we have controlled every case by fluoroscopy and we feel that any other method is inaccurate. Whipple (43) states that the aspiration of bile is a sufficient proof, yet Lyon (25) writes that bile is not present in the fasting duodenum normally. One deduces, therefore, that all Whipple's cases were pathological. Some investigators tell us that the patient can locate the tip subjectively if aided now and then by pumping in some air, others think a certain resistance on tugging locates the tube as through the pylorus. Suffice it to say that none of these methods has proven reliable in our hands when controlled by fluoroscopy

However, having determined by the X-ray that the tube is correctly placed and having obtained specimens of fasting gastric and duodenal contents and specimens of "A" "B" and "C" bile, what conclusions may we deduce from their examination? The gastric and duodenal contents are examined as to reaction, color, and cellular and bacteriological findings, chiefly for control. Let us say at once that in all our cases except those of total biliary obstruction, the fasting duodenal content has always been bile-stained. This is true even in normal cases. This has always mystified us a little, especially as Lyon (25) regards it as an abnormal finding and since Ballenger, Brams, and Klodnitzky (21) in Pawlow's laboratory working with dogs on the secretion of bile, found that bile was ejected intermittently into the duodenum and only rarely in the fasting state. Can it be that the presence of the tube in the pylorus serves as a sufficient stimulus?

The examination of the three specimens of bile is the most important part of the test. The color changes are first observed and on them depends the correct sequestration of the bile. We have always found it difficult to recognize this change in color. Yet difficult as it is, we have come to place most reliance on this factor. Herein lies the value of the investigator acquainting himself with the reaction in normal cases. Without this experience in normal cases it is almost impossible to judge pathological ones.

Microscopical examination of the sediments, except for outspoken cases of obvious gall-bladder infection with pus in the sediment, has proven of little value. The mixture with gastric content which now and then comes over, probably in some cases more than in others because of paralysis of the sphincter, the lack of specific characteristics of cells in the biliary passages, and the multiplicity of possibilities renders any judgment based on such a study open to criticism. The knowledge of biliary disease gained from such a study cannot be as valuable as that obtained concerning the kidneys by a study of urine sediment. Today little weight is placed on such findings.

Bacteriological examination of the specimens has also proven unreliable in our experience, less because of contaminations or un-

TABLE I.—NORMAL CONTROL CASES

Case and Suite No.	Age, Sex, Occupation	Chief Complaint and Duration	General Condition	Findings in Test					Psychopathic Diagnosis	Operation	Remarks
				Stomach Contents	Duodenal Contents	Bile—A	Bile—B	Bile—C			
[illegible] 1501	31 Bricklayer	Pencil [illegible] 3 months	Excellent	Normal acid	Bile-stained, alkaline	Golden yellow, clear, alkaline	Dark brown, alkaline, clear	Light yellow, [illegible]	[illegible]	[illegible]	[illegible]
[illegible] 1502	[illegible]	Appendicitis" [illegible]	Grossly [illegible] tions. 15 years of constipation. Rare blood in stools from piles. Physical examination negative	Benzidine slight acid	Bile-stained, clear, alkaline	Golden yellow, clear alkaline, glucozone crystals	Brownish color, milky. Alkaline to acid, glucozone crystals	Lemon color, clear, few crystals, alkaline	Acute [illegible]	No [illegible]	[illegible]
[illegible] 1503	36 Druggist	Pain in lower right quadrant 24 hours	Excellent. Past history, negative. Physical examination negative	Alkaline, benzidine +, rare red blood cells and white blood cells	Greenish, alkaline	Golden yellow, clear, alkaline	Dark brown to black, alkaline, clear	Pale yellow, alkaline, clear	Dextrocardia, [illegible]	No [illegible]	
[illegible] 1504	17 Schoolgirl	Pain in lower abdomen 1½ months	Excellent. Past history, negative. Physical examination negative except for tenderness in right lower quadrant	Acid, normal	Alkaline, bile-stained	Pale, clear, lemon color, neutral	Alkaline, dark brown	Neutral, lemon color	Schizophrenia [illegible]	[illegible]	
28518 14328	2 Stenographer	Pain in right lower quadrant 1 to 3 attacks in last 5 years	Good. Occasional attacks of indigestion, constipated. Physical examination, tender in right lower quadrant	Acid, normal	Alkaline, golden yellow, clear	Alkaline, light yellow, amorphous precipitate	Dark, clear black, large amount	Pale waters lemon	Chronic [illegible] psychosis	No [illegible] Liver, [illegible] cystic. Gall bladder [illegible]	[illegible]
27938 14276	46 Maid	Pain in lower abdomen 3 months	Appendix, tubes and uterus out 17 months previous. Constipation with gas for years. Physical examination negative	Acid, lemon yellow, squamous cells, few crystals	Alkaline, bile-stained	Alkaline, brown, clear	Alkaline, very dark brown, clear	Alkaline to acid, much lighter yellow color	Diverticulitis	No operation	[illegible]
28870 14328	48 Housewife	Abdominal distention with pain. Duration indefinite	Influenza. 1 abdominal operation in Italy. Physical examination negative	Acid, bile stained, amorphous cells	Only 3 cubic centimeters obtained. No bile in this. Alkaline	Alkaline to acid, golden yellow, later milky, amorphous cells	Darker yellow brown, alkaline to acid, amorphous cells	Pale yellow green, acid, clear	Psychopathic personality	No operation	

usual findings than a failure to obtain positive cultures. Whipple (43) reported a striking similarity of the organisms identified by the test and at operation. Possibly some special media, as Lyon suggests, are necessary, and some special technique. It is true that we have several times seen bacteria in the microscopical study of the sediment, and yet failed to grow an organism on any of the media inoculated. Time and again we have supposed a failure to obtain growth on artificial media was due to the known inhibitory effect of bile on the growth and life of most bacteria, and other investigators (Garbat, 15, Einhorn and Meyer, 12), have reported that bacteria can often be demonstrated in gall bladders from which no positive culture can be obtained. Lyon (24) has advocated sterilization of the upper gastrointestinal tract, but in our experience this is not feasible, and unnecessary because of the proven sterility of this field (7) due to the action of gastric juice (16, 18, 27).

Thus the technique of the performance of the test is simple only in description. The necessary controls make it a complicated affair, for they necessitate bacteriological, microscopical, and X-ray apparatus. And, if one is studying the test, not merely performing it, normal control cases and an examination of the gall bladder either at operation or autopsy are essential. The necessity for normal controls is obvious, and it was unfortunate that such controls were not reported by the originators of this test, since the absence of such controls has led to much confusion in the translation of findings, and has thrown much doubt by subsequent workers on the value of a brilliantly imaginative idea. For well over a year, we have had the opportunity to study this test in relation to the diagnosis of gall-bladder disease.

MATERIAL INVESTIGATED

A. Normal controls. The test as described by Lyon with the modifications stated above was used. In each instance the tip of the tube was localized in the first portion of the duodenum by fluoroscopy before adding the magnesium sulphate solution. The cases cited are from the surgical clinic of this hospital, and can be criticized on the basis that no patient coming into a hospital is normal. However, the cases in this normal group were selected [illegible] in which no symptom of past or present gall-bladder or liver disease could be elicited and the similarity of findings is striking. The opportunity to explore two of these revealed the normal gall bladder suspected when the test was performed. The eight cases reported are typical of all other control-cases studied (Table I).

Our observations served two purposes (1) to establish the normal sequence of findings in the contents of the duodenum aspirated after the instillation of magnesium sulphate, and (2) to educate our own discrimination as to normal changes in the color of the specimens of bile obtained. We soon found this latter was very important, since the differences between normal and abnormal color changes are often difficult to detect. In fact we do not believe this power of discrimination can be given by written description, but must be had by first hand experience by all who intend to use the test.

This group of normal cases resulted in findings comparable to the results reported by Lyon. That is, we were able in each instance to sequestrate specimens of bile as "A," "B," or "C" bile according to the color changes. At the same time the beginning and end points for "B" bile were often rather arbitrarily distinguished because of the very slow and slight change in color and other physical attributes. It seemed, however, that by this test it might be possible to obtain three differing specimens of bile which would appear, from their physical characteristics, to represent common duct ("A" bile), gall-bladder ("B" bile), and hepatic duct or liver bile ("C" bile).

Bacteriological and cytological studies were made on all specimens sequestrated. Records of these findings are not included on the chart but it may be said that in none of the normal cases cited was a bacterial growth obtained. A study of the sediment was made as a routine, but the type of sediment varied in accordance with the amount of gastric content that came over during the collection of the specimens. Abnormal numbers of leu

TABLE II.—CLASS I. NO GALL BLADDER "B" BILE

Case and Surg. No.	Age, Sex, Occupation	Chief Complaint and Duration	General Condition	Findings in Bile					Pre-operative Diagnosis	Operation	Result
				Stomach Contents	Duodenal Contents	Bile "A"	Bile "B"	Bile "C"			
30001 14561	61 Jobber	Pain in upper right quadrant, recurrent 1 year	Fair. Poor teeth, palpitation, precordial pain, nocturia, nervous, has been jaundiced	Clear, watery with few solid particles. Acid	None obtained in 15 minutes	Acid, yellow, clear. Culture—fat, rounded Gram+ motile bacillus	Same	Same	Cholelithiasis	[illegible]	[illegible]
27978 13920	40 Housewife	Headaches, epigastric distress 2 years	Good Teeth poor	None obtained	Acid, dark brown to yellow green Few white blood cells	Acid, light lemon yellow, clear. Gross and microscopic blood. Rare red blood cells	Same but lighter	Same	Cholelithiasis	Thickened, adherent gall bladder. Liver studded with nodules with necrotic centers containing salt deposit	Cholecystectomy. Recovery uncomplicated
27809 13706	36 Housewife	Right upper quadrant pain 3 years. Nausea and vomiting	Good	Acid, watery, turbid, mucoid	Alkaline, 5 cubic centimeters bile-stained fluid, squamous cells Few white blood cells	Alkaline to neutral, pale greenish Intermittent flow Cholesterol crystals	Same	Flow stopped	Cholelithiasis and cholecystitis	Distended, scarred gall bladder. Few large stones, one impacted at cystic duct of gall bladder	Cholecystectomy. Good recovery
27494 13697	52 Housewife	Upper abdominal pain 10 years	Good	Alkaline, watery, mucoid, epithelial cells	Alkaline, cloudy, flocculent, bile stained. Few crystals	Alkaline, clear golden yellow, viscous. Cultures—bacilli gram negative	Same	Same	Cholelithiasis and cholecystitis	Adherent to gall bladder Stone in ampulla of gall bladder. Bile stained few crystal	Cholecystectomy. Good recovery
27635 13763	64 Housewife	Pain in the right side 15 years	Fair. Dyspnœa and palpitation, œdema	Acid, watery, mucoid with yellowish streaks Rare white blood cells and red blood cells	Acid, clear golden yellow Many white blood cells	Acid, golden orange brown. Many white blood cells. Few crystals. Few bacilli	Same	Same	Cholelithiasis and cholecystitis	Large, atonic, irregular bladder. Many smooth faceted black stones	Cholecystotomy. Good recovery
28070 14400	25 Dressmaker	Abdominal pain 6 months	Good	Acid, pale green, flocculent. Rare white blood cells	Alkaline to acid, golden yellow turbid. Rare white blood cells	Alkaline, clear golden yellow. More white blood cells	Same	Same	Acute cholecystitis with cholelithiasis	Large, distended acute gall bladder. Many loose stones	Cholecystectomy. Good recovery
27933 13952	39 Housewife	Pain in right side 1 year	Good. Suggestive jaundice	Acid, benzidine + ; watery, mucoid, gross blood streaks	Alkaline to neutral. Bile-stained	Neutral, clear golden yellow	Same	Vomited tube	Cholelithiasis	Thickened, adherent gall bladder with stones Ampulla of gall bladder packed with same	Cholecystectomy. Good recovery

TABLE II. CLASS I. NO GALL BLADDER "B" BILE—CONTINUED

Case and Surg. No.	Age, Sex, Occupation	Chief Complaint and Duration	General Condition	Findings in Test					Preoperative Diagnosis	Operative Findings	Remarks
				Stomach Contents	Duodenal Contents	Bile "A"	Bile "B"	Bile "C"			
[illegible]	[illegible] Junk dealer	Pain in stomach 6 to 7 years	Good. Adenopathy	Acid, watery, mucoid, clear	Alkaline, clear at first. Later bile stained, deep	Alkaline greenish, turbid with reddish brick. Benzidine + +	None	None	Chole[illegible]	Dense [illegible]	Cholecystectomy. [illegible] ostomy. [illegible]
[illegible]	[illegible] Housewife	Pain in right side 4 years	Good. Otalgia left for 1 year. Hematuria rather frequently. Treated for cystitis	Acid, watery, clear, mucoid	Neutral, cloudy, mucous with flakes of blood. No bile	Neutral, golden yellow, clear. Culture—colon bacillus	None	None	[illegible]	[illegible]	[illegible] lusions. Incidental [illegible] Good recovery
[illegible]	[illegible] Housewife	Weakness and headache 1 year	Poor. Gall-bladder demonstrated 1 year ago. Headache. Pyorrhea. Duodenal Vomiting and hematuria. Enlarged liver	Acid, hemolytic + + watery, mucoid green	Alkaline, pale green, turbid. Epithelial cell. Rare white blood cells	Alkaline to neutral, pale green. Epithelial cell. Rare white blood cells	None	None	[illegible]	[illegible]	Repair of stricture. Insertion [illegible] mon duct
[illegible]	[illegible] Domestic	Pain in upper right side [illegible]	Good. Operated [illegible] condition [illegible]	Acid, semi-opaque watery mucoid	Alkaline, bile-stained, clear	Alkaline [illegible]	[illegible]	[illegible]	[illegible]	None [illegible]	[illegible]
[illegible]	[illegible] Farmer	Pain, [illegible] 1 year	Poor. [illegible] Marked [illegible]	Acid, watery, opaque, [illegible]	Alkaline, yellow. Many epithelial cells. Few white blood cells	Alkaline to neutral, [illegible] Negative	None	None	[illegible]	[illegible]	[illegible]
[illegible]	[illegible] Housewife	[illegible] 1 year	Good. [illegible]	Acid, [illegible]	Acid, bile-stained, [illegible]	Alkaline, [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	Pain, [illegible] 1 year	[illegible] Poor. [illegible]	Acid, mucoid, [illegible]	Alkaline, [illegible]	Alkaline, [illegible]	None	None	[illegible]	[illegible]	[illegible]

cocytes were never noticed, nor was there any evidence of the presence of cells that could be definitely attributed to the biliary tract.

Thus far, our experiences were in accord with those of Lyon, but a study of subsequent material shows that abnormal tests were obtained in normal cases. The latter are not included in this chart, since we have classified all cases according to the test findings and not according to the lesion found.

B. Pathological cases. Since our primary attempt was to study the test and not disease, we have placed in the pathological class all cases giving an abnormal test. As will be shown in the discussion not all such patients showed the pathological anatomy suggested by the examination. For convenience the cases giving an abnormal test are classified as: Class I, cases in which no gall-bladder bile "B" bile), was obtained; Class II, cases in which there was abnormal gall-bladder bile "B" bile); Class III, in which only a trace of bile was obtained in any of the specimens sequestrated; Class IV, in which no bile at all was obtained, and Class V, cases with extra-biliary pathology.

Table II covers 14 cases in which the test gave no evidence of "B" bile (Class I). We have included only those which, either by repeated examination or the striking picture in the original test, convinced us that the result obtained was consistent. It seemed as if, in these cases, there must have been good anatomical reason for the failure to obtain gall-bladder bile.

All cases came to operation and in 10 of them (71.4 per cent), the test diagnosis was substantiated. In the remaining, operation revealed no mechanism which could have prevented emptying of the gall bladder provided contrary innervation of the sphincter of Oddi and the gall bladder exists. Case No. 27975, on repeated examination, gave no gall-bladder bile and yet a gall bladder was found without obstruction. It was, however, thickened and gave evidence of an old inflammatory process. It is conceivable that such a condition might cripple its contractility, although syphonage could have emptied it had the sphincter of the common duct relaxed and if its diseased condition permitted relaxation and collapse. This patient was unrelieved by cholecystectomy and it is presumed that the enlarged and evidently diseased liver was the cause of the symptoms. Case No. 28075 showed a duodenal ulcer, the surrounding inflammation of which had involved the gall bladder resulting in thickened, leathery walls. Cholecystectomy was performed incidental to posterior gastro-enterostomy. In Case No. 27342 nothing pathological was found except a small transduodenal band which was divided. This patient was apparently cured. The positive bacteriological findings in this case might have explained the failure to obtain gall-bladder bile through resultant inflammatory œdema, except for the fact that bile removed from the gall bladder at operation showed no growth. This leads us to the opinion that the growth obtained by the test was due to contamination. Case No. 30454 on three repeated tests showed no gall-bladder bile. Exploration revealed a normal gall bladder which was not removed. Subsequently this patient returned with the same symptoms. The test was again repeatedly pathological. This time the gall bladder was removed and proven normal by histological study.

A study of the table shows that bacterial findings were present in 5 cases, 35.7 per cent. Cytological study of the sediments gave us no further assistance. In No. 28976, in spite of the presence of an acute cholecystitis, no culture was obtained from the specimens of bile and only a few leucocytes were present in the sediment.

In those cases in which an abnormal test was corroborated by biliary pathology at operation, we found obstruction produced by stone in the cystic duct or sedimentation of stones in the ampulla. However, in such a case as 28976 where there was an acute, tense, dilated gall bladder the obstruction seemed to be due more to mucoid exudate than to stone. Naturally other agents than stones can cause obstruction. That a simple mucous plug can result in a large, tense gall bladder is no argument against the contractility of the gall bladder through the stimulus of contra-innervation on relaxation of the sphincter of Oddi. This we shall take

up later. Case No. 27770 is presented to emphasize the findings in cases where no gall-bladder bile was obtained. Obviously without a gall bladder and when no infection is present, the test would give the same result as with simple cystic duct obstruction. In case No. 27897 in which the gall bladder also had been removed, we have another comparable case although the operative findings of a common duct stone complicates the picture. The thin yellow fluid recovered, doubtless represented the fact that only a small amount of bile came through.

Thus in this first series of pathological cases in which no gall-bladder bile was obtained the test found a rather high percentage of corroboration at operation. We cannot say, however, that it made any diagnosis more easy nor that it changed an opinion already reached by physical examination and history. In fact in cases Nos. 27975, 28075, 27342, and 30454 it led us to the diagnosis of stone in the gall bladder or cystic duct whereas operation revealed no such lesion.

In the 5 cases in Class II—abnormal gall-bladder bile obtained by test—in which changed or abnormal bile was obtained for specimen "B" bile the most striking feature was the color change (Table III). In all cases the line of demarcation from "A" bile was very sharp and the "B" bile was characterized by being very dark, often viscid and in one case contained actual fine, putty-like black particles. In most of these cases an abnormally large amount was obtained which would lead one to suspect a dilated, static gall bladder, the amount of gall-bladder bile ranging from 160 cubic centimeters to 70 cubic centimeters. The deductions to be drawn from such a pathological, concentrated, dark bile in large amounts would naturally lead one to suppose the gall bladder was dilated, atonic, probably infected, and that because of inability regularly to empty itself, the bile became continually more concentrated (Rous and McMasters, 37). Bacteria were isolated from 3 of the 5 cases.

All cases came to operation where the test findings were substantiated. In case No. 28909 there were only a few adhesions but an atonic gall bladder. In three cases in which cultures were obtained cytological examination showed polymorphonuclear leucocytes in the latter almost to the exclusion of other cells. The particles coming through in case No. 27243 were putty like pigment and seemed to be composed of an amorphous rather than crystalline substance.

In this group the pre-operative diagnosis of stone was made as much on the history as because of the test findings. The positive features of the latter were the increase in amount and evident static quality of the bile obtained. Naturally this cannot be translated into anything more definite than gall-bladder disease. Why stones in case No. 27753 sedimented in the ampulla should allow bile to get out and stones in the same situation in Class I should obstruct, we cannot say. The findings in cases Nos. 27753 and 27243 were possibly indicative of stone but certainly could not be taken as absolute evidence.

There are but few cases in Class III very little bile obtained which is as one would expect, for the finding of very little bile means obstructive jaundice, and clinically this is only a small group. All cases were jaundiced. In all but the last case the jaundice was intense. In all cases the reduction in the amount of bile obtained was striking, in case No. 28780, this was so marked that there was great question as to whether any bile was present or not until repeated tests were performed. Two of the four cases were operated upon, one, case No. 30773, showed pancreatitis and cholecystitis without stones. This patient died and autopsy was refused so that the final reason for the obstruction is still unknown. Case No. 28434 was clinically malignant disease. Operation confirmed this diagnosis, though the tissues in the region of the gall bladder, pancreas, and duodenum were all so matted together that the actual origin of the tumor was not determined. It is our opinion that with carcinoma involving the common duct there are no obstructive signs or symptoms until that obstruction is complete. In this case, therefore, although the biliary system was involved, we think the tumor originated in some neighboring structure. Of the cases

TABLE III.—CLASS II. ABNORMAL GALL BLADDER BILE OBTAINED BY TEST

Case and Surg. No.	Age, Sex, Occupation	Chief Complaint and Duration	General Condition	Findings in Test					Pre-operative Diagnosis	Operative Findings	Result
				Stomach Contents	Duodenal Contents	Bile "A"	Bile "B"	Bile "C"			
27755 13845	57 Housewife	Pain in right side 2 weeks	Good	Acid, benzidine +, yellowish watery, mucoid White blood cells + +	Alkaline, golden yellow, clear	Alkaline, brownish clear, few cholesterin crystals	Alkaline, green-black, 120 cubic centimeters, very many cholesterol crystals	Alkaline, light brown, gold color, few crystals	Chronic [illegible] and cholelithiasis	[illegible] Large [illegible] gall bladder	[illegible]
28573 14105	43 Housewife	Pain in stomach 6 months	Poor, very obese, debilitated, left breast amputated previously, myocarditis	Acid, watery, mucoid with some bile-staining	Acid, 8 cubic centimeters, clear, yellow fluid	Alkaline, golden brown, flow free	Alkaline, very dark brown, 60 cubic centimeters, turbid, many amorphous cells and white blood cells, culture colon bacillus	Same but much lighter	Cholecystitis and cholelithiasis	Large [illegible] gall bladder [illegible]	Cholecystectomy Left recovery
27243 13890	70 Nightwatchman	Pain in stomach, jaundice, itching 9 months	Poor, headaches, malaria 30 years ago, lost 15 pounds in 2 months, teeth poor, obese	Acid, benzidine slightly +, watery, mucoid, rare red blood cells and white blood cells	Alkaline, pearly clear, no bile, culture staphylococcus and colon	Alkaline, 1.8 cubic centimeters, yellow golden, turbid, cellular debris + +, small, black hard particles, culture staphylococcus, colon and diplococci	Alkaline, red brown, turbid Cellular debris, culture staphylococcus and colon	Same lighter	Cholelithiasis, stones in common duct	Large [illegible] stones in common duct and in [illegible]	[illegible] Drain
25527 12784	68 Farmer	Itching with jaundice 8 weeks	Fair, typhoid at 13, rather emaciated	Acid, clear, watery, mucoid	Acid, clear, watery, mucoid,	Alkaline, pale yellow, clear	Alkaline, 120 cubic centimeters of very dark bile	Alkaline, same but very light	Cholelithiasis, stone in common duct	Stone in common duct	Cholecystotomy. Choledochotomy. Dead
28099 14441	51 Janitress	"Sick at stomach" 4 months	Good, hysterectomy 7 years ago, hernia in scar	Acid, mucoid, watery, few epithelial cells	Alkaline, bile stained	Alkaline, light yellow, few white blood cells	Alkaline, 70 cubic centimeters dark, thick, viscid, culture colon	Alkaline, light bile	Cholecystitis, atonic gall bladder	Adhesions about gall bladder	Repair of hernia done at operation. Good recovery

TABLE IV.—CLASS III. VERY LITTLE BILE OBTAINED

Case and Surg. No.	Age, Sex, Occupation	Chief Complaint and Duration	General Condition	Findings in Test					Preoperative Diagnosis	Operative Findings	Remarks
				Stomach Contents	Duodenal Contents	Bile "A"	Bile "B"	Bile "C"			
s0778 1527	68 Dairyman	Jaundice 6 to 7 weeks	Good, constipation for years, vague indigestion, jaundiced	Acid, yellow turbid	Acid, greenish, epithelial cells	Neutral, pale yellow orange green, epithelial cells, few cocci, cultures colon bacillus streptococci gram +	Neutral, same color, same sediment, same culture	Neutral, same color, slightly lighter, same sediment same culture	Cholelithiasis, common duct stone	Pancreatitis Cholecystitis Non-common duct stone	Patient died Autopsy refused
[illegible]	57 Housewife	Jaundice 5 months	Poor, thin, jaundiced, enlarged heart, mitral stenosis, liver enlarged	Acid, normal	Alkaline, cloudy, pale straw color Gmelin test +	Alkaline pale yellow Gmelin test +	Alkaline cleared slightly, pale straw color	Same as B	Carcinoma of head of pancreas	No operation	Died [illegible] Very faint amount of pale straw bile
[illegible]	[illegible]	[illegible]	Good except for large gallbladder, very palpable	Acid, normal, flocculent precipitate	Alkaline, yellow brown Gmelin test positive Cultures Bacilli	Alkaline same through out, colorless Gmelin test	Same	Same	Carcinoma of pancreas	No operation	Died [illegible] Gmelin test positive Organisms found in [illegible]
[illegible]	[illegible] Negro, [illegible]	Pain in [illegible] region, [illegible] [illegible] [illegible]	Pale, emaciated, [illegible] [illegible] [illegible]	Alkaline, mucoid [illegible] [illegible]	Alkaline, cloudy, yellow brown	Alkaline [illegible] Gmelin test +	Same	Same	[illegible]	[illegible]	Died [illegible]

TABLE V.—CLASS IV. NO BILE OBTAINED

Case and Surg. No.	Age, Sex, Occupation	Chief Complaint and Duration	General Condition	Findings in Test					Preoperative Diagnosis	Operative Findings	Remarks
				Stomach Contents	Duodenal Contents	Bile "A"	Bile "B"	Bile "C"			
[illegible]	[illegible] Housewife	Nausea, vomiting, [illegible]	[illegible] Emaciated, [illegible] [illegible] Gmelin test negative Death [illegible]	Acid, [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TABLE VI.—CLASS V. CASES OF PEPTIC ULCER

Case and Surg. No.	Age, Sex, Occupation	Chief Complaint and Duration	General Condition	Findings in Test					
				Stomach Contents	Duodenal Contents	Bile "A"	Bile "B"	Bile "C"	
27907 11 '08	42 Dressmaker	Pain in pit of stomach and right side 5 years	Excellent. Physical examination and past history negative	Acid, watery, mucoid, no bile, epithelial cells, white blood cells++	Alkaline, lemon yellow clear	Alkaline, golden yellow, clear	Alkaline, very dark brown, almost black	Acid, light brown	A normal
28397 12 '08	36 Housewife	Pain in pit of stomach 2 months	Good. Pelvic operation 2 years ago. Varicose veins of left leg. Family history of tuberculosis	Acid, watery, mucoid, blood tinged with yellow strands, bacteria	Alkaline, clear, watery, mucoid, bacteria++, rare red blood cells and white blood cells	Alkaline to neutral, light bile, clear, rare white blood cells	Alkaline, dark brown, clear, tenacious, amorphous debris, few white blood cells. Culture—colon bacilli	Alkaline to acid, light	Other pat
28780 12 '08	36 Weaver	Pain in right hypochondrium. Number of attacks during last 3 years	Excellent. Physical examination and past history negative	Acid, watery, mucoid	Alkaline, dark brown, clear, tenacious, amorphous debris, few white blood cells. Culture—colon bacilli	Alkaline, golden yellow, amorphous	Alkaline, very dark brown, almost black	Acid, lemon yellow, clear,	

not operated upon, No. 28397 was one of post-operative cicatricial stenosis and No. 28780 left the hospital without operation. Later she reported to a neighboring hospital, still jaundiced, and operation revealed stones in the gall bladder, pancreatitis, and a thickened common duct. No stones could be found in the papilla at operation, but it is fair to say the patient's condition did not admit very thorough exploration.

As stated in the discussion of Class III one would expect to find obstructing cancer when no bile was obtained by the test (Class IV). Here, however, is a case of proven common duct stone in which no bile was obtained. The explanation in such cases may be in the fact that through trauma from the stone the muscle fibers of the sphincter of Oddi have degenerated into connective tissue, thus being unable to dilate when in contact with magnesium sulphate. Such an idea, however, is entirely hypothetical.

Because of the occasional similarity of the symptoms of duodenal ulcer and gall-bladder disease, it seemed wise to study the reactions of this test in cases of peptic ulcer (Class V). We have placed three proven cases of ulcer in a separate chart with reports of their test findings. Of these, two showed normal tests, in one case substantiated at operation and in the other by a typical X-ray picture of duodenal ulcer. Case No. 27907 gave a distinctly pathological test. Dark, infected, turbid bile was recovered, although operation disclosed a typical, small, duodenal ulcer and the gall bladder appeared in every way normal. No explanation is available, but it may be that the restriction in diet had made such a small demand for bile that the process of concentration had been going on for some time.

DISCUSSION

The brilliant conception of this procedure and the hope that its use would simplify diagnosis and treatment in a difficult field of medicine have brought it into immediate and general use. An examination of the evidence already published from many sources reveals the greatest conflict as to the reliability of the test. Lyon himself in a series of admirable papers (23, 24, 25, 26) has fully

explained the test and has cited numerous case reports in support of his theoretical claims. Whipple (43), Brown (4), Friedenwald and Morrison (14), Niles (32), Smithies, Karshner and Oleson (39), White (44) and Jones (20) have all either published statistics favorable to the test or have held out high hopes as to its value. Reports by Dunn and Connell (10), Crohn, Reiss and Radin (6), and by Bassler, Luckett and Lutz (2) have shown contrary evidence, much of which would seem to disprove the hypothesis upon which this test rests.

The basis of the test centers about whether or not the law of contrary or crossed innervation exists in relation to the gall bladder and the sphincter of Oddi. Meltzer (29) gives an excellent summary of the physiological facts accepted in regard to this mechanism up to 1917 when his paper was published, but presents no experimental proof, though the similarity to the action of the detrusor and sphincter muscles in the urinary bladder is striking. Freese (13) has shown that the force of contractility of the gall bladder is scarcely higher than the limits of secretory activity. And no evidence has yet been submitted proving that the gall bladder contracts with any appreciable force. However, Freese (13) and Doyon (9) have shown that the innervation of the gall bladder is through the splanchnic nerves, and the latter demonstrated weak contractions of the gall bladder upon stimulation of the peripheral end of the nerve when it was divided. Meltzer (29), relying on the law of contrary innervation and his observation that a 25 per cent solution of magnesium sulphate when applied directly to the mucous membrane paralyzes the gut at that point, suggested that the use of this drug through a duodenal tube in diseases of the biliary passage might paralyze the sphincter of Oddi and cause contraction of the gall bladder.

The hypothesis that the gall bladder acts as a storage chamber in which the bile is concentrated has recently been proven by Rous and McMasters (37, 38). Pawlow's pupils (3, 5, 21) have long since demonstrated the intermittent dejection of bile into the intestines, the flow depending upon the presence of food in the stomach. That the mechanism of bile dejection depends on either nervous or hormonic influences seems to be shown by the fact that in the latter's experiments the sphincter muscle itself lay isolated from the gut and in contact with the skin and, therefore, no food or chyme could act as a direct stimulant to the sphincter muscle.

Up to the present time [illegible] the mechanism by which the gall bladder is emptied. The work of Boldireff (3), Bruno (5), and Klodnitzky (21) demonstrated that food in the stomach is a sufficient impulse. They did not analyze the stimulus further. But various investigators have since shown that the presence of various inorganic salts (11), chyme (35), peptone (42), and especially weak hydrochloric acid (2, 33) are insufficient stimuli for the dejection of bile into the duodenum (19). In our own experience, the constant finding of bile in the normal fasting duodenal content may be taken as an indication that the presence of a foreign body alone (the duodenal tube), is a sufficient stimulus, and Moppert (31), has shown that a thread through the pylorus calls forth the same reaction. These facts would seem to show (1), that there are a great number of substances of both chemical and physical nature which may call forth the dejection of bile and (2), that this stimulus need not necessarily reach the papilla of Vater.

So much for the known physiology of the stimuli that cause a dejection of bile. It seems reasonable to suppose that relaxation of the sphincter of Oddi depends on a nervous or hormonic influence that can be initiated by various factors, among these magnesium sulphate. In the case of magnesium sulphate its action may be direct inhibition of the sphincter muscle. McWhorter (28) has shown that magnesium sulphate applied to the duodenal mucosa reduces the pressure within the bile ducts appreciably. However, this must not be taken as evidence that, coincident with relaxation of the sphincter, the gall bladder contracts. There are in fact many clinical observations (2, 30) that in anæsthetized patients and in our own experience when novocaine was used for the exposure, no contraction of the gall bladder

follows the introduction of magnesium sulphate into the duodenum. Crohn, Reiss and Radin (6) and Johnson (19) report the same findings in experiments on animals. There is here no proof of the law of contrary innervation.

Are we to suppose then that the specimens secured depend entirely upon syphonage? A study of the foregoing cases has led us to the belief that this is the factor by which bile is obtained in this test. We base this on the facts that (1), there is no evidence of gall-bladder contraction and (2), because in several cases in which no gall-bladder bile was obtained, operation failed to demonstrate any obstruction that a simple weak contraction of the gall bladder would not have overcome. In fact we did obtain bile from diseased gall bladders in which the musculature was obviously sclerosed. Such gall bladders, however, were not so diseased but that they might have collapsed with syphonage. It is true that in the majority of cases there was definite obstruction by stone, but in such cases one would expect colic or other symptoms if the gall bladder was stimulated to contract. The case reported by Dowden and Enfield (8) would seem to show that there are stimuli that cause contraction of the gall bladder. In their case it happened to be the passage of the duodenal tube. On the other hand such reports are infrequent and need further support. Knight (22) has recently brought forward the interesting suggestion that the flow of bile depends on the hypertonicity of the duodenal contents plus the mechanical action of distended neighboring organs. The part that neighboring organs, diaphragm, respiratory movements, and peristalsis play in the emptying of the gall bladder has long been a favorite theory and is fully described in the recent papers of Harer, Hargis, and Van Meter (17) and Schmieden and Rohde (39). We accept the fact, therefore, that following the administration of magnesium sulphate, bile is poured into the duodenum, but have been unable to find any evidence that it is expelled by intrinsic contractions of the gall bladder.

Can one now differentiate the bile obtained into specimens that represent common duct, gall-bladder, and liver bile? The separation in the test is made chiefly by visual judgment. In normal cases, as reported above, there is, following the instillation of magnesium sulphate, first a flow of light bile, next from 20 cubic centimeters to 50 cubic centimeters of a darker bile which then grades off into a discontinuous flow of light lemon-yellow bile. The darker middle specimen was taken to represent gall-bladder bile. Does it? Lyon argues that its similarity to the concentrated bile in the gall bladder proves this, but others report such a dark bile in cholecystectomized cases (2). In our own experience we have not found such dark bile in patients from whom the gall bladder has been removed. Rous and McMasters (38) found that in experimental animals with the gall bladder removed the bile secreted by the duct was thin and diluted! Rost (35) pointed out that after removal of the gall bladder, the escape of bile was thin and continuous and Rous has denied the possibilities of the formation of a new gall bladder unless a portion of gall-bladder tissue remained. Thus we cannot argue in defense of the test that should dark bile appear in cholecystectomized cases, it comes from a reformed gall bladder, since the division is almost always made in the region of the cystic duct. Specht's experience (41) both with dogs and man is further evidence along this line. Bassler, Luckett and Lutz (2) thought the color change in these cases was due to the excess presence of oxidase. Einhorn (11) is of the opinion that the re-excretion of the magnesium salt gives the darker color. One would suppose from this that the outpouring of dark bile once initiated would continue for some time, whereas after 40 cubic centimeters to 80 cubic centimeters of dark bile has appeared, one again sees the lighter colored fluid.

Lyon also places value on the cellular and bacteriological findings in the various specimens. He feels that the type of cell, and especially the intensity of its stain with bile, may be of aid in both the segregation of the specimens and the diagnosis of the condition. Polymorphonuclear leucocytes are certainly more common in infected cases and in conjunction with positive bacteriological findings.

In our experience, however, they have been present when we failed to grow bacteria from the bile obtained from the gall bladder at operation, and when operation revealed no gross infection. As to other cells, it is our opinion that the morphology of cells long in solution is so changed, and the danger of contamination and confusion with gastric and duodenal contents is so great that any evidence based on such criteria is of no value. Rothman-Manheim (36), using peptone as a means of stimulating the flow of bile, felt that the evidence obtained from a study of the cellular elements was of assistance. He points out that leucocytes are numerous in infectious conditions with cholecystitis and cholangeitis, and epithelial cells in catarrhal conditions. Bassler, Luckett, and Lutz (2) found that cells of inflammatory nature are present in all parts of the biliary tract when infection exists. In our own experience the evidence deductible from a study of the cellular element has certainly been of no value.

Our bacteriological studies have been equally indefinite. In some cases in which positive cultures were obtained from the gall bladder at operation, all pre-operative test specimens were normal. Again the reverse was true and pre-operative test cultures could not be corroborated by cultures taken at operation. It is a well-accepted fact that gastric and duodenal contents are in the great majority of cases sterile. The recent work of Poppens (34) in which he found bacillus coli occasionally and rarely streptococci and staphylococci, agrees with other experimental studies (Cushing and Livingood, 7). Hajos (16) has shown that the degree of sterility depends on the presence of gastric acidity. Hoefert (18), for example, has recently reported that, using the duodenal tube, under normal conditions of health and gastric secretion, specimens of the duodenal content are usually sterile. Here, again, the determining factor proved to be the hydrochloric acid of the gastric secretion. This study is merely a corroboration of the work of Aaron (1), and MacNeal and Chace (27). Garbat (15) showed that bile is usually sterile, although organisms may be found in it. He attributes this to the inhibitory effect of bile on bacteria. And Einhorn and Meyer (12) found that gall-bladder bile showed no bacteria although organisms could be demonstrated postmortem in the gall-bladder wall. Whipple (43), on the contrary, found great similarity in pre-operative test findings and cultures from the gall bladder at operation. We feel, however, that in view of the accepted usual sterility of the upper digestive tract and because of the unusual nature of some of the organisms reported, this evidence needs corroboration before acceptance.

SUMMARY

Interest in this procedure as an aid in both the diagnosis and treatment of biliary conditions has become widespread. Already it has reached the hands of the general practitioner, and in spite of the difficulty of carrying through its correct performance is in actual practice by a large number of doctors. This is exceptional in a profession usually conservative and leads one to think that the many careful studies already reported, which seem to show that the knowledge the test may give is unreliable, are not generally recognized. It is possible also that the strong psychic appeal any such a procedure must awaken in a patient has led doctors as well as patients into a false sense as to the real physical good this manœuvre can give.

Following the above discussion, it is our opinion that there is much to be proven before the so-called "Meltzer-Lyon" test can be accepted as of value in aiding diagnosis, that it should still be considered as only in an experimental stage, and its use should be discouraged by any except those who are qualified and equipped to study and criticize its value. It is by no means a simple test. Should one grant all that Lyon claims for it, to be exact, it requires X-ray apparatus, much time, repeated examinations on all cases, and elaborate bacteriological and cytological studies. The test depends upon the law of contrary innervation which must be proven before the test is accepted. At the present time the evidence would seem to show that syphonage is the principle factor in the dejection of bile into the duodenum. Exactly what determines the intensity of the

color of the bile remains a question. In our opinion dark bile comes from the gall bladder, and this accords with the recent work of Rous and McMasters (37) and Harer, Hargis, and Van Meter (17) on the concentrating ability of the gall bladder. We have never found real dark bile in cholecystectomized cases. However, the contentions of Einhorn and Meyer (12) that the dark color is due to re-excretion of the salt or to destruction of red cells in the liver with the production of excess iron or the belief of Bassler, Luckett, and Lutz (2) that such color is due to an increase in the amount of oxidase must bear further study.

Our own experience has left us with the distinct impression that the test is not of dependable diagnostic aid. With its use in treatment except for a few rare cases we have no experience.

The lack of unanimity in the results obtained by different investigators is the best proof of the unreliable status of this test at the present time.

CONCLUSIONS

1. The "Meltzer-Lyon" test is based upon the application of the law of contrary innervation to the biliary system. There is no proof of this at present.

2. It is our opinion that the specimens of bile obtained are the result of syphonage.

3. The test cannot be depended upon for diagnostic purposes even when accurately performed.

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LIPOMA OF THE TENDON SHEATHS

With Report of a Case and Review of the Literature

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LIPOMA of the tendon sheaths is a rare disease, as is shown by the fact that there are only 18 cases reported in the literature. There are two distinct types: lipoma arborescens and lipoma simplex symmetricum. Clinically they may be considered together, because the symptoms, signs, locations, treatment and prognosis are the same. In fact, pre-operatively they have seldom been diagnosed.

J. Mueller first used the term lipoma arborescens in 1838, describing a case in which the growths occurred in the knee joint. Virchow described them in the abdominal cavity, 1847. Billroth was the first to mention their occurrence in tendon sheaths, and did so as follows:

"In synovial folds and villi of the joints as [illegible] the tendon sheaths, there may be an abnormal fat formation, so that the masses of fat seem to be branched like a tree. Lipoma Arborescens. J. [illegible] the [illegible] colon (appendices epiploicæ) and other serous membranes."

The etiology is unknown. Sprengel and Pancritius demonstrated in their [illegible] of lipoma simplex the origin of the tumor in the subsynovial fat lobules of the mesotendon. Hoefel in reporting his case of lipoma arborescens stated that they are analogous in origin to those from the villi of the joints. Michailoff considered these growths a manifestation of tuberculosis. He reported two cases but one of them had pulmonary tuberculosis, and tubercles were demonstrated in the tumors. Therefore it must be classed as tuberculous tenosynovitis. Broca quoted by Sendler, regarded their formation as a healing stage of tuberculosis. Sendler's patient died of acute pneumonic tuberculosis 5 months after operation, and yet there was no evidence

of tuberculosis in the tumors, microscopically. In fact, no evidence of tuberculosis has been shown in any lipoma reported, and guinea pig inoculations when attempted have been negative. Garé wrote: "Under tuberculous tenosynovitis I include fungous and rice body hygroma of the tendon sheaths." Cassanello described his tumor as showing lipomatous and chronic inflammatory tissue, and therefore concluded that these lipomata are the result of chronic inflammation, the nature of which is not clear. Kummer noted that lipoma arborescens does not resemble a tumor, but an alteration of the synovial membrane such as an inflammation could produce; that they often penetrate the tendon and dissociate its fibers like a malignant or fungous tumor, not like a true lipoma. Therefore, he concluded that they do not belong in the class of tumors, but that they are the result of chronic inflammation. He considered the cases of Haeckel and Kurz as synovitis proliferans described by Kœnig, and he favors this term for them. Lambret shows a preference for classing lipoma arborescens among the inflammations but does not attempt to state the nature of the inflammation causing the tumors. His case seems to disprove inflammation as a cause, as the symptoms began when the child was only 2 years of age. Hueter quoted by Tichoff thinks them a manifestation of rheumatoid arthritis, and Tichoff himself in 1895 considered them the result of chronic inflammation of rheumatoid arthritis, but in 1908 wrote that they were the result of a successful struggle of the sheaths against tuberculosis. To argue that the formation of a fatty deposit is the end-result of an inflammatory process, and to base those arguments upon the scanty fibrous and vascular structure which can be found, is, to say the least, a dangerous procedure, and can be in no way convincing. Moreover, it must not be forgotten that tuberculous tenosynovitis is not uncommon, and yet lipoma of the tendon sheaths is extremely rare. The same comparison may be made with chronic arthritis. The specimens removed from the author's case resembled in every way a lipoma in any other location. It is such a rare disease that occupation cannot be considered a cause. Six of the patients worked hard with their hands. But as the tumors occurred also in a child of two and in young girls, work cannot be considered an etiological factor. Trauma too has not been a factor.

Lipomata of the tendon sheaths are composed of fat tissue without any evident capsule other than the sheath itself to which they are so intimately attached that the sheath must be sacrificed in removing the growth. They may be more fibrous than the ordinary lipoma elsewhere. They may contain in places more blood vessels than other lipomata, and, therefore, have a reddish tinge. The arborescent type consists of villi composed of very thin, branching pedicles several millimeters long. Each branch bears on its end, one, two, or sometimes three, lobules of fat, 2 to 5 millimeters in diameter. There may or may not be fluid within the sheath. At times the growth may be extremely adherent to the tendon, so that part of the latter must be removed with the lipoma as in Kurz's case. The tendons may be thinned or intact. They may be completely surrounded by the lipoma or entirely free. Microscopically the tumors show fatty tissue and in places a distinct fibrous network and numerous blood vessels, while in other places they present the typical picture of an ordinary lipoma. No tubercles have been found in the lipoma or the surrounding tendon sheaths.

A review of the literature shows that lipomata have occurred in the sheaths of the following tendons:

	Times
Extensor digitorum communis	0
Peroneus brevis	4
Peroneus longus	3
Extensor digitorum communis longus	1
Extensor pollicis longus	3
Extensor pollicis brevis	3
Extensor carpi radialis longus	4
Extensor carpi radialis brevis	3
Flexor digitorum communis sublimis	4
Flexor digitorum communis profundus	4
Extensor hallucis longus	1
Extensor indicis proprius	3
Extensor digiti minimi quinti	3
Extensor radialis brevis	1
Extensor tendons of both forearms (W. Meyer	1
Extensor ulnaris	1
Abductor pollicis longus	1

The earliest age of onset was 2 years; the oldest 34. Fourteen were between the ages of 15 and 30, one was 8, one 12, one 34, and one 32.

The duration of the tumor and the symptoms varied from 1 to 19 years, one case each, and the average in 19 cases was 7.6 years. Sometimes this was different in the same patient in different locations. One tendon might be affected from 1 to 7 years after another had shown a tumor. A patient may be affected first on the one hand then on the other, or on a hand and then on a foot. But the tumor may be located on only one extremity.

The consistency of the tumor has been variously described as soft, elastic, fluctuant, semifluctuant, tense, firm. They are not tender. Crepitation was noted in 4 cases, absent in 5, and not mentioned in 10. Fluctuation was present in 9, not definite in 1, pseudo in 1, absent in 3 and not mentioned in 5.

Disability is the commonest symptom. The function of the members controlled by the affected tendons is impeded generally because of pain. The pain may be slight or very severe. It may be absent when at rest and severe when at work. Disability, or impaired function, was present in 16 cases, no disability in 1, and not mentioned in 2. Pain was present in 13 cases, absent in 2, and not mentioned in 4.

The tumor is domeshaped, situated along the course of the tendons, and moves with them and is usually elongated in the direction of their course. The skin over it is intact, freely movable and of normal color, and may carry veins that are slightly dilated.

As will readily be imagined from the description and location of the tumors, the commonest pre-operative diagnosis has been hygroma of the tendon sheaths. Jaksch had Sprengel's case in mind and therefore mentioned the possibility of lipoma while he made the diagnosis of hygroma. Then followed Sendler, who made the probable diagnosis of lipoma. Kurtz and Meyer diagnosed their cases tuberculous tenosynovitis. D[illegible] reported by Fossier) thought he was dealing with a case of tenosynovitis. Lambret was [illegible] Kummer and Bogoluboff diagnosed lipoma. [illegible] the author himself thought it was tuberculous because of the absence of pain and tenderness. The fluctuations may be very distinct. In the author's case it was so definite that he attempted to aspirate first for diagnosis, but no fluid was obtained, nor was there any found at operation. Crepitation may be so definite that rice bodies are diagnosed. If the lobules feel distinctly larger than the usual rice bodies, one may suspect lipoma arborescens. Garré thinks these growths develop more slowly than the tuberculous condition, but this hardly seems definite enough to base a diagnosis on. Pain, disability, and physical signs likewise are not characteristic. Therefore, it may be concluded that when dealing with a [illegible] the differential diagnosis must rest among hygroma, tuberculosis and lipoma, and the last has the least claims in being the correct diagnosis because of its rarity.

The only treatment for lipoma of the tendon sheaths is ablation. In removing the growths, it is necessary to remove much of the sheaths. This, however, causes no postoperative complication, either in healing or in function. When the tendons tunnel through the lipomatous growths, very careful dissection is necessary to avoid cutting them. The author prefers the block method of local anæsthesia described by Braun. This enables the patient to aid the operator by moving the tendons at will until the motor power is [illegible] affected by the anæsthetic. This, however, is lost only after the sensation is lost and returns before sensation. In the author's second operation the patient had no sensation in the back of her hand until 6 hours after the injection was made. Sometimes massage is given for a time following the operation, but this is not always necessary.

The prognosis is good for complete return of function, and the growths do not recur.

Fig. 1. Lipoma of tendon sheaths on dorsum of both hands and volar surface of right.

Fig. 2. After removal of lipoma from tendon sheaths of dorsum of left wrist.

Fig. 3. Right hand. Swellings due to lipomata of tendon sheaths.

The author's case was a female, domestic, age 27, single, born in the United States. Her family history was negative. Her past history was negative except for sore throats and occasional colds. Her menstrual history was normal. She presented herself April 25, 1921, because of a lump on the back of each hand. She wanted these growths removed because they made her hands look so ugly. The swelling on the back of the left hand appeared 3 years ago and grew slightly. That on the right she noticed 2 years ago after grabbing a flat iron very quickly. It came suddenly and remained the same size. They never ached or caused her any pain or disability. Four months ago she had visited her doctor on account of these swellings, because they were unsightly. And he, thinking they were caused by an inflammatory condition in the wrists advised her to have her teeth examined with a view to extraction, if a focus of pus was found. The dentist reported that X rays of her teeth showed: "Hypercementosis lower right cuspid, first bicuspid, lower left first bicuspid and upper right second bicuspid. Abscess upper left lateral and unerupted impacted upper left cuspid." The two last-named teeth were extracted in January, 1921.

Examination. The patient was well nourished, somewhat pale. Her upper left teeth were missing. The rest of her teeth were in good condition. The isthmus of thyroid was palpable and slightly enlarged, but she had no hyperthyroid signs or symptoms. Her heart and lungs were negative. The only other positive findings were to be noted on her two wrists. On the dorsum of each wrist was an irregular, lobulated swelling extending from the upper edge of the carpus two-thirds the distance downward over the second, third, and fourth metacarpals with prolongations over the extensor tendons of the thumbs. The tumor on the right hand measured 6 by 4 centimeters; that on the left was a little smaller. Running transversely across the tumors near the middle, was a depression. The skin over them was movable and normal in color, with dilated veins. The tumors were soft, fluctuant. No crepitation and no distinct edge could be felt. There was no increase in local temperature, no pain, no tenderness. The tumors moved with the tendons. On the right wrist there was also a swelling, small but with similar characteristics, on the volar surface just under the palmaris longus and between the ends of the radius and ulna. April 29, to rule out hygroma, aspiration was attempted on the tumor of the left hand, but no fluid could be drawn. The diagnosis then rested between lipoma and tuberculosis of the tendon sheaths. On May 18, 1921, by Braun's block method with 0.5 per cent novocaine, the tumor on the dorsum of the left hand was extirpated. An incision 6.5 centimeters long over the middle of the tumor was made, the sheath incised, and the fat tumor exposed. It was found to surround the tendons so that it looked as if the tendons had tunneled through. The tendons so involved were the extensor digitorum communis, extensor indicis proprius, extensor digiti quinti. These all had to be dissected out, and the sheath removed with the tumor. Similar tumors were removed from and with the sheaths of the extensors carpi radialis, pollicis longus and brevis, through another incision 4 centimeters long over the volar

Fig. 4. Two tendons of extensor digitorum communis partly dissected out of the lipoma.

Fig. 5. Author's removal of lipomata

hands had healed, showing the linear

surface of the head of the radius. All the tumors extended upward under the ligamentum carpi dorsale which was incised part way. The wound was closed by suturing the [illegible] and then the skin. A splint was used for 6 days, when the sutures were removed. The wound healed *per primam* and the patient was discharged well, May 28. The function was perfect on June [illegible]. The patient had no massage.

June 21, 1921, the tumor on the right hand was operated upon with the same findings. It was all done through one incision 6 centimeters long. A subcutaneous suture only was made. The wound healed *per primam*. July 21, the function was perfect. The patient had no massage.

Both tumors were solid lipomata, in some parts a little vascular, friable, and easily stripped from the tendons. The patient helped protect her tendons by moving them when requested, as the motor paralysis was not as lasting as the anæsthesia. The local anæsthesia lasted 4 hours at the first operation. The patient had no pain in the back of her hand until 6 hours after the injection for the second operation. On November [illegible] 1921, the patient was seen. The scars were firm with a tendency to keloid. The skin on the dorsum was free, the fingers moved as always, the power the same, and there was no recurrence. The tumor on the volar surface of the right wrist was not operated upon. All the tumors were solid lipomata, therefore the final diagnosis was lipoma symmetricum multiplex.

[illegible] ters in diameter. Cuts with moderate resistance. The cut surface shows nothing but a mass of fat tissue. Four other pieces were present which were fibrous in nature, and two of these had small pieces [illegible] sections of the sheath.) These cut with the ordinary [illegible] tion shows nothing but fat cells. There is one area which shows fibrous tissue in which a moderate infiltration of [illegible] typical tubercles. There is no evidence of tuber- [illegible]

Simple lipoma.

The following are the cases reported in the literature in chronological order.

[illegible] the article.) Female, age 30, had swelling on the thenar surface of left wrist. Several typical lipomata were removed from the tendon sheaths at operation.

Case 2. Haeckel's case. A cooper age 57. Became a cooper at 14. Did hard work with hands. At first noticed severe pain in joints of hand that he could only work for a time. Noticed a swelling on back of left hand the size of a pea. Doctor prescribed rest and treatment of iodine. Tumor persisted. Pain disappeared but recurred when work was resumed. In 1877, tumor the size of hazelnut was diagnosed as hygroma at Bonn surgical clinic, and was incised. Streaky, pale yellow fluid almost like the white of an egg flowed out. Patient wore compression bandage 3 weeks and waited another 3 weeks before returning to work. Recurred and was repeatedly operated without permanent result. Meanwhile a tumor the size of a fist appeared on the dorsum of the right hand. It was less painful and no treatment was given. In 1885, a short time before admission, another attempt was made to remove the tumor by incision. This failed and the doctor said it had become hard, and must be excised. Therefore, admitted. Examination showed on the left hand a tumor just below wrist and extending downward, reaching the middle of the third and fourth metacarpals. It was raised and flat, measured 4 by 7 centimeters. Movement of tendons moved the tumor somewhat. Skin over tumor was movable and color unchanged. The tumor had a soft, elastic consistency and distinct fluctuation. In the depth could be felt apparently concretions grating on each other. On the right hand was a similar tumor on the dorsum, similarly situated but somewhat softer in consistency. It was about 2 by 7 centimeters. Diagnosed hygroma. Operations: Left. Incision 8 centimeters. Sheaths of extensor tendons laid bare and incised. There flowed out a slight amount of thin, stringy, yellow fluid and numerous fatty villi. The parietal layer of the sheath was thick, the villi adherent mainly to that part of the sheath next to the skin. Some were removed from the sheath but in places the sheath had to be removed with them. Some of the tendons in the thinned-out sheath were thinned for distances up to 3 centimeters.

One such place on tendon was surrounded by a small tumor the size of a hazelnut. All removed and wound closed. Some growths when extirpated had bases 3.5 centimeters long. Others were smaller and fused with a short pedicle to the sheath. Only the larger ones had longer pedicles, and branched from the one pedicle to the others, each bearing a ball of fat so that they resembled a bunch of grapes. Others were club-shaped of pear-shaped without a stem. A third type was sessile and cylindrical. All were yellow and of soft elastic consistency. The surface was smooth. Microscopic examination showed fat cells and interstitial tissue carrying blood vessels. The villi themselves were inclosed in a membrane and showed fibrous tissue. Tumor on right hand was removed through 10 centimeter incision. A little more fluid and also more lipomatous growths were found. Diagnosis: Lipoma.

Case 3. Sprengel's Case. Lipoma symmetricum multiplex. Patient an orphan girl age 10. For 2 years had had chronic rheumatism in different joints. Ankle joints became so painful it was almost impossible for her to walk. Patient was pale and weak. On both ankles were swellings corresponding to the tendons of the peronei and extensor digitorum communis longus musles. Movements of ankle joints were somewhat restricted. There was no tenderness, crepitation or fluctuation. Diagnosis of hygroma was made. Plaster-of-Paris casts were applied and left for 3 weeks. This was followed by massage with no improvement.

Operation, November 29, 1886. An incision was made over the tumor on the peroneus tendon. The sheath was opened and a fat tumor was exposed extending from the muscle substance of the peroneus brevis to its insertion into tuberosity of fifth metatarsal. Tendon freed. Same found and accomplished on tendons of extensor digitorum communis longus and on other foot. No fluid was in the sheath. Patient was soon well and walking. No recurrence in 1 year. Sprengel considered that these lipomata originated in the fat lobules of the mesotendon.

Case 4. Haeckel's case. Lipoma arborescens. A cabinet maker 21 years of age. Onset 3 years ago with pain in left index finger. Gradually all the fingers of the left hand were affected and at the same time a moderate swelling of the flexor tendons of the fingers was noted. The swelling varied in size from time to time. The pain was worse when he was working, and diminished after rest. Examination showed firm, painful swellings on first phalanges of third and fifth fingers. One could feel rice bodies grating when the patient moved his fingers. The same sensation was obtained on the tendon of the extensor pollicis longus although no tumor could be palpated. On the right hand there was crepitation at the first phalanges of the fourth and fifth fingers. Function was good in these fingers but the strength was diminished in the fingers of the left hand.

Diagnosis of hygroma was made.

Operation. An incision was made from the middle of first metacarpal to the anterior edge of the dorsal carpal ligament on the left hand. The sheath of extensor pollicis longus was opened. A stringy fluid escaped. The growth was exposed and found to extend upward to where the extensor radialis longus crossed. The tumor extended along the latter tendon too. Similar growths were removed from around the flexor tendons of the third and fifth fingers and flexor profundus and sublimis and vincula tendinum. The tendons and sheaths for 5 centimeters were involved and the tendons were in some places surrounded by the tumors. The tumors were bright yellow, soft, and pedunculated, club-shaped or in clustered forms. All proved to be lipomata. Haeckel stated that this case was analogous in origin to that of lipomata in joints from villi, as Schmolk described.

Case 5. E. Kurz's case. A peasant woman 28 years of age, healthy and strong. In 1886 she had

pain for some time in fingers of right hand which had now become weaker. She could not use it well for her work. Gradually there developed a tumor on the back of this hand close to the wrist. When first noticed it was the size of a pigeon's egg, elongated, sharply outlined, not definitely fluctuant, and followed somewhat the movements of the extensor tendon of the middle finger.

Diagnosis of hygroma was made. Aspirated teaspoonful of yellow fluid was obtained, but hard body remained. Three months later it had grown to the size of a hen's egg. Pain had increased. It was situated over the extensor tendons of the three middle fingers. There was no crepitation, no tenderness. Probability of tuberculosis was considered.

Operation under cocaine. Lipoma found surrounding the extensor tendons of the three middle fingers. In haste the operator knicked the tendons in several places in freeing the tumor. The extirpated mass was two handfuls of large and slender villi of fat and connective tissue.

Case 6. R. Jaksch. May 16, 1888 extirpated tumor of tendon sheaths. Patient 23 years old, active soldier, always well except for present condition of feet. At age of 16, noticed hard tumor growing on dorsum of right foot. Also a similar one on left foot, of 3 months' duration. Gives long course of great extensors. Inflamed 3 days before admission.

Left: After the inflammation subsided examination showed a longitudinal tumor which extended from base of first metatarsal along the course of the tendon of extensor hallucis longus over first cuneiform and scaphoid to the forward edge of astragalus. It was hour-glass in shape, the smaller part behind the narrowing in the middle. Width varied from 1 to 2.5 centimeters. There was fluctuation and soft crepitation. Surface was smooth, skin movable over the tumor, and the tumor movable over the bone. Attached to extensor tendon of great toe, the function of which was impeded and painful. The relatively rapid development and repeatedly inflamed conditions with pain spoke for hygroma, but Jaksch had in mind lipoma as described by Sprengel. Apparently symmetrical with this was a tumor the size of a walnut on the right foot at the base of first metatarsal. Base of the tumor was hard and connected with the bone, the upper part of it which the extensor hallucis moved, felt soft and somewhat fluctuant. Considered exostosis with formation over it of ganglion.

Operation on left foot. Tendon sheath opened, fluid escaped. Therefore tumor had developed from inside of sheath on dorsal surface. It was about 1 centimeter long, and had two prolongations. Tendon left untouched. Tumor and sheath removed from extensor hallucis longus. The specimen was generally soft in consistency but firmer in center.

Microscopic examination. Fat tissue infiltrated with connective tissue. Therefore fibrolipoma with inflammatory reaction.

Operation [illegible] on the right [illegible] with the tumor [illegible] will [illegible] tendon [illegible]

Case [illegible] duration was gradually growing. No pain, until recently when pain and weakness in fingers developed.

Examination showed soft pseudofluctuant elastic mass, which reached to ligamentum carpi dorsale, and sent distally 3 processes on extensor tendons of [illegible] meters wide. Skin over it normal and mo[illegible]

Diagnosis Lipoma.

[illegible] lipoma. [illegible] tuberculosis. November 10, patient died of rapid tuberculosis. Tumor on one hand only.

Case [illegible] years patient had swelling on dorsum of left wrist. [illegible] patient noticed some pain at edge of tumor, and also weakness in elbow and shoulder. One year later, he noted a swelling on analogous place on right wrist [illegible]

[illegible] lobulated, not fluctuant, not painful to pr[illegible] but presenting a crepitation which accompanied the [illegible] tumor was divided by a transverse furrow into anterior and posterior parts. It was movable on underlying tissue. Movements of hand and fingers free. Hand closed firmly enough. Right hand same but tumor smaller.

Diagnosis. Tenosynovitis, probably fung[illegible] Because the malady progressed and caused weakness of hands and arms it was decided to extirpate the growth.

Operation [illegible] tensor tendons from anterior edge of metacarpals to within 1 centimeter of ligamentum carpi dorsale. Sheath incised, little, yellow, viscid, transparent fluid escaped. The inner surface of the sheath and tendons themselves were covered with lobulated vegetations resembling fat. Sheaths extirpated completely and tendons cleared. Tendons found thin in places. Tendons involved were, extensores digitalis communis, proprius indicis, and minimi quinti. Same operation and findings on other hand.

Gross *Pathology.* Growths [illegible] longitudinal [illegible] to color and [illegible] nules. Pedicles generally several millimeters long and very thin and uniquely branched. [illegible] lobule, sometimes two and rarely three, on its end measuring 2 to 5 millimeters in diameter.

TABLE I.—CASES FROM THE LITERATURE

Author	Age and Sex	Duration of symptoms	Location of Lesion	Consistency	Fluctuation	+	±	−	Tendons	Type of Lesion	Position	Bursa	Remarks
Peyser	F 50		Left wrist										
Hoffmann	M 27	1 yr. 2 yrs.	Back of left hand, back right wrist	Soft, elastic	+	+	—	+	Marked	Hygroma	Lipomatous	Yellow	Extensor tendons of fingers
Schmidt	F 40	1 yr.	Both wrists		○				Unable to walk	Hygroma	Lipomatous	None	Extensor tendons
Hoffa	M 21	1 yr.	Flexor surface and ext. surf. of flexor joint	Firm		+	—	+	Marked	Hygroma	Lipomatous	Yellow	Extensor tendons of fingers / Flexor tendons
Kurz	F 38	Some time	Right wrist	Dense	Not definite	○	○		Marked	Probable tuberculous	Lipomatous	Yellow	Extensor tendons of middle finger
Jacob	M 30	3 yrs. 2 mos.	Right foot / Left foot	Soft	+	+	—	—	Moderate	Hygroma	Lipomatous	Yellow	Extensor tendons
Stadler	F 24	1½ yrs.	Back left hand	Soft, elastic	Possible	—	—	+	Moderate	Probable hygroma	Lipomatous	Brown	Extensor tendons / Origin of ulnar head of flexor carpi ulnaris
Kummer	M 30	11 yrs. 11 yrs.	Back left wrist / Back right wrist	Soft		+	+	—	Moderate	Extensive tuberculous	Lipomatous	Yellow	Extensor tendons of fingers
Doyen	F 31	2 yrs.	Back of wrists		+	—	—	+	Moderate	Extensive	Lipomatous	Serous	Extensor tendons of fingers
Lambret	8	6 yrs.	Back of left wrist		+	+	+	+	Present	Hygroma, not Probable	Lipomatous	—	Extensor tendons of fingers
Meyer	F 42	1½ yrs. 11 yrs.	Back left hand / Back right hand		—	—		—	Marked	Tuberculous	Lipomatous		Extensor tendons of fingers
Pancritius	M 30	10 yrs. 1 yrs.	Back both hands / Left ankle	—	+	—	—	+	—	—	Lipomatous	—	Extensor tendons both hands / Peroneus tendon
	F 50	1 yrs.	Left ankle			+		+	Marked		Lipomatous		Peroneus longus and brevis
Dithoff	M 55	5 yrs.	Both wrists volar surface			—	—	—	—	Hygroma	Lipomatous	—	Flexor tendons both hands
Michaelis	M 30	—	Dorsum wrists	Elastic		—	—	+	—	Lipomatous	Lipomatous		Extensor tendons / Extensor carpi radialis brevis
Bogdanoff	F 42	3 yrs. 3 yrs.	Right wrist / Dorsum left wrist			—	—	+	Marked	Lipomatous	Lipomatous		Flexor digitorum communis profundus right / Extensor digitorum communis both
Cassinello	F 20	10 yrs.	Dorsum wrists	Soft	+	—	—	+	Moderate	Tuberculous synovitis	Lipomatous	None	Extensor tendons / Extensor carpi radialis longus et brevis / Extensor carpi ulnaris
Bidman	M 30	1 yr.	Dorsum both wrists	Rice bodies	+	—	—	+	Present	—	Lipomatous	—	Median nerve / Extensor pollicis longus and extensor pollicis brevis
Streit	F 27	3 yrs. 1 yr.	Dorsum left hand / Dorsum and volar surface right wrist	Soft	+	+	○	○	None	Probable lipoma	Lipomatous	None	Extensor digitorum communis / Flexor digitorum profundus

+ means present, ○ means absent, — means not mentioned.

Microscopic examination showed fatty tissue in fibrous tissue network and tumor on blood vessels. No signs of inflammation, no tuberculosis. Guinea pig inoculations negative. Patient later became a chauffeur in Paris.

CASE 9. Deces's case reported by Fossier. February 11, 1895, Mlle. D. teacher, age 21 entered the surgical clinic of Dr. Deces for 2 small symmetrical tumors on the dorsal side of each forearm. When questioned about the onset of the trouble, she said that 3 years before she was suddenly taken in the night with very bad pain in her fingers. These pains which lasted about 2 hours never recurred. Only, after this occasion she noted that her forearms were less strong; at the same time there appeared little by little a small tumor above each wrist.

Examination. To the sight on the dorsal side of each forearm, 2 or 3 centimeters from the radiocarpal articulation, one noticed a small hemispherical tumor the size of half a nut. On palpation, this benign tumor, slightly movable fluctuated a little. As to function, the patient complained of difficulty in writing and carrying things.

Diagnosis. Tenosynovitis.

Operation. Several treatments having been applied without result, an operation was performed by Dr. Deces February 13, 1895. An incision of about 4 centimeters made on each forearm laid bare a little lipoma the size of an almond surrounding completely the tendon of the extensor radialis brevis. The left one, slightly larger, was clearly lobular. Besides, there was found on both side in the tendon a small quantity of serosanguinous fluid, due probably to the irritation of the synovial tendon, caused by the presence of the lipomata. Operation and recovery were uneventful. Patient completely well February 21, 1895.

CASE 10. Lambret's case. Patient age 8 years. February 19, 1902, complained of tumor of back of right hand. Tumor situated on course of common extensor tendon, united with them and elongated parallel with them. It occupied the inner half of back of hand corresponding to third, fourth and fifth fingers. It first appeared at the age of 2 and grew without being noticed. Since then it has been painless, but for some time it has caused difficulty in extending the fingers. The skin over it is healthy and movable. There is fluctuation, but no crepitation. Child has always been healthy. Family history negative.

Diagnosis. Hygroma with rice bodies.

Operation. No fluid. Diffuse lipoma arborescens of tendon sheath of common extensor. The fatty lobules covering the tendons were removed piecemeal. Tendons were gradually cleaned. The sheaths with the same vegetations were removed where accessible. Healed *per primam.*

CASE 11. W. Meyer's case. February 10, 1897, presented before New York Surgical Society. A woman age 48, operated on in 1892. Removed tendon sheaths of extensor tendons of both forearms for [illegible] proved to be lipomatous degen[illegible] been present [illegible] left wrist and [illegible] right. Disease of [illegible] hand, especially [illegible] chronic. Patient shows [illegible] of lipomatous [illegible] gland affected [illegible] By [illegible] completely restored. (Author's note: this [illegible] reported as [illegible] in the literature, [illegible] and no further [illegible] obtained from Dr. Meyer.)

CASES 12 and 13. Marburg cases reported [illegible] Pancritius. 2 cases. (a) 34 years old. First Lieutenant. 10 years ago he was afflicted with ulcus [illegible] which healed rapidly and later iritis which healed under [illegible] treatment. [illegible] swelling on back of right hand [illegible] of little finger. In 1881 this was aspirated and [illegible] Gradually [illegible] a swelling on left hand [illegible] In 1889 pains became severe and he could not ride. In [illegible] Unsuccessful. Therefore, November 6 [illegible] came to Marburg surgical clinic.

Examination showed fluctuating swelling in tendon sheaths on back of left [illegible] metacarpophalangeal joint in flexor tendon sheaths of the middle finger [illegible] phalanx. Left elbow both sides of triceps tendon. Supination, flexion, and extension limited. Right shoulder in front of [illegible] crepitation. No limitation. Both knees [illegible] enormous mount of fluid and crepitation. Extension complete and flexion nearly so. No [illegible] Definite diagnosis not made. Prepared for [illegible] tion.

Operation. November [illegible] left knee opened. Piece of membrane excised for diagnosis. Marchand reported "reddened, swollen synovial membrane with fat tissue. Piece of the right knee joint showed no tuberculosis." November 21, 1893, left elbow showed no fluid, just thick capsules. Incised subdeltoid bursa exposing thick capsule with villi on right shoulder. November 30, left knee was opened, villi removed consisting mostly of fat. December [illegible] wounds healed. Joint [illegible] movement was [illegible] bursa, finding large wall studded with villi, very hyperaemic [illegible] rice bodies. [illegible] on back of left hand. Tendons surrounded by diffuse lipoma which arises from the thickened tendon sheaths. Excised. Also extirpation [illegible] joint [illegible] of wrist. January [illegible] which had become [illegible] badly swollen. A pound of villi consisting of fat was removed. January 30, incision on dorsum of right [illegible] was made. [illegible] with the mesotendon of the lipoma on the extensor ulnaris was easily recognized and the lipoma extirpated. [illegible] phalangeal joint [illegible]

extensor tendon were exposed, and the joint surface of the metacarpus showed a central ulcer. Left foot showed large lipoma on the tendon peroneus. Again connection with the mesotendon was distinct.

Result. Convalescing.

[illegible] old girl. Family history negative. [illegible] age of 16 she noticed pain on outer side of left leg. No known cause. Rice bodies were found in knee, and 20 cubic centimeters of fluid were aspirated. In 1894 swellings on both wrists and right knee got well of themselves. The lesion of the left knee and foot got worse. July 2, [illegible] status: pains in outer side of both ankles and weakness in left knee. In left popliteal space a diffuse swelling which disappeared with flexion. Flexion somewhat limited. Tumor size of an apple fluctuant, not connected with knee joint and not tender. Under external malleoli sausage-shape tumors, movable and no crepitation.

Diagnosis. Hygroma in popliteal space. Others not diagnosed with certainty, but lipoma of tendon sheaths considered probable.

[illegible] Circumscribed lipomata removed from tendons and sheaths of peroneus muscles on both sides. Tumors were 4 centimeters long and size of finger in thickness. Hygroma in popliteal space found.

Case 14. Tichoff's case. Man age 34. Onset five years ago with slight swelling on volar surface of both wrists. These grew steadily. One year later noticed pain in both knee joints which swelled at times. On volar surface of right wrist there was a lobulated swelling 5 centimeters long extending up the forearm from the head of the metacarpals. It measured 12 by 8 centimeters. The swellings seemed to be a series of tubercles.

Diagnosis. Hygroma of tendon sheaths.

Operation. Tendon sheaths of flexor tendon of fingers filled with reddish yellow masses. These were extirpated, tendons freed.

Microscopic diagnosis. Lipoma.

Case 15. Michailoff's cases, cited by Bogoluboff.

(a). Male, age 32 years, carpenter. Complained of pain in right shoulder joint. He had two elastic swellings over tendon sheaths of extensor carpi radialis brevis and longus.

Probable diagnosis. Lipoma arborescens. Confirmed by operation and microscopic examination.

(b). Male, age 29 years, with lipomata which under the microscope proved to be tuberculosis. Therefore this case is excluded from consideration in this review.

Case 16. R. Cassanello's case. A seamstress age 30 years. As a child she had chronic inflammation of cervical glands and catarrhal pharyngitis. Onset of present illness 10 years ago with fever and profuse sweats that lasted about 10 days. Then she noticed tumefactions on dorsum of both wrists. These swellings grew gradually to the present size, that of a tangerine orange. At times she had pain radiating up the arms and to the fingers, especially the middle finger. This interfered with her work and therefore she sought relief. She presented a tumor at the mid-dorsum of each wrist of equal size. They extended from radiocarpal joint to metacarpophalangeal line. They felt lobulated and fluctuant like a soft fibroma.

Diagnosis. Fungous tenosynovitis of extensor digitorum.

Operation. Midline incision over length of tumor. No fluid in sheaths. Extirpation and resection of tumor and tendon sheaths. Tendons involved were extensor digitorum communis and extensor proprius indicis of both hands. Findings: Soft lipoma arborescens of villous, piriform and grape shapes.

Microscopic examination. Typical lipoma with many vascular loops surrounded by transverse and longitudinal fibroblasts. Definite evidence of granulation tissue. Because of the findings of lipoma and definite chronic inflammatory tissue, Cassanello diagnosed it fibrolipoma. Nature of chronic inflammation not clear. But no tuberculosis.

Case 17. H. S. Biilmann's case. Male 26 years, previously healthy. About a year ago noticed a swelling at lower end of left radius. It grew gradually to the size of 4 by 3 centimeters. It felt as though it contained rice bodies. Movements of hand normal. Patient complained of inability to do his work because of pain which came and went.

Operation. Chloroform anæsthetic. Longitudinal incision over tumor which proved to be lipoma simplex of tendon sheaths of abductor pollicis longus and extensor pollicis brevis. Extirpated. Wound healed *per primam.*

Case 18. Bogoluboff's case. Girl, age 21 years. Onset 5 years before with swelling of right wrist. This swelling came and went and varied in size from time to time, always appearing after hard manual labor. The remissions became less frequent until 3 years ago when the tumor became permanent. A little time after the swelling started on the right hand she noticed a like tumor similarly placed on left wrist. This too came and went before it remained permanent. The pain also became so severe in the past year that she could not do her work.

Examination. The tumor extended over the extensor digitorum communis tendons up to the ligamentum carpi dorsale and measured 11.5 by 6.5 centimeters. There was an additional swelling on volar surface of right wrist in region of flexor digitorum communis.

Diagnosis. In all probability, lipoma arborescens.

Operation. Cocaine anæsthetic. Lipoma removed. Sheath widely distended with tumor which grew from parietal wall.

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SPLENECTOMY IN BANTI'S DISEASE, THIRD STAGE

WITH REPORT OF TWO CASES, ONE WITH PORTAL W[illegible]

BY DAVID FISHER, M.D. N[illegible]

SPLENECTOMY, as a therapeutic procedure in itself, needs no comment, nor voluminous writings to lend support to it, for enough cases are on record to show that it has a distinct clinical basis of value, and has come to be recognized as a common surgical procedure. Its scope has been widely extended of late, however, as can readily be seen by an analysis of the conditions which have become amenable to removal of the spleen.

W. J. Mayo, in summing up splenectomies for all causes, in the Mayo Clinic up to January 1, 1921, analyzed 249 cases with a mortality of 10 per cent. Seventy-one cases were for splenic anæmia of unknown origin, with 9 deaths; 38 cases were for splenic anæmia of known origin, among which were 11 cases of chronic sepsis following systemic infections due to septic arthritis, tonsillitis, phlebitis, and osteomyelitis. The operative mortality in these cases was 27.3 per cent, the remainder being cured or greatly relieved. Six spleens were removed for chronic syphilis, with a mortality of 16.6 per cent. Eight spleens were removed for splenic anæmia in children and von Jacksch's disease with no deaths; 11 for portal cirrhosis with 4 deaths; 32 cases for hæmolytic jaundice; 6 for primary biliary cirrhosis; 27 cases for myelogenous leukæmia after proper preparation by irradiation. Improvement in these latter cases, however, was only temporary. Thus it [illegible] removed, whatever be the primary cause, with an exceedingly low operative mortality and with quite excellent results. If splenectomy is indicated when the splenomegaly is secondary, then that same indication exists with [illegible] to be the primary disorder.

As for splenectomy in the syndrome commonly called Banti's disease, especially in the terminal stage marked by ascites, cirrhosis of the liver, intense jaundice and enlarged spleen, one becomes quite surprised as [illegible] looks over the past records, by the remarkably few numbers of cases which have found their way into print, whether or not they resulted in recoveries.

Sweetser, in an admirable summary, was able to collect only 42 cases reported in the past 20 years, in which spleens were removed when complicated by ascites and enlarged liver. Due to the meagreness of some of the reports, and to the frank difficulty in separating true cases of Banti's from other conditions closely simulating this, he deliberately included in his summary 7 cases of primary cirrhosis of the liver with ascites, 3 of syphilis with cirrhosis and ascites, 1 of splenic and portal thrombosis with enlarged spleen and ascites, and 1 of primary lymphosarcoma of the spleen with ascites. Thus, of the 42 cases

[illegible] etiology, and have remaining, 30 cases of splenectomy which presented unknown etiology, enlarged liver and spleen, and ascites. As for the immediate mortality, before [illegible], in 11 reported cases it was 72.7 per cent, from [illegible] in 16 reported cases, the mortality was 56 per cent, and in the above 42 cases, the mortality was further reduced to 26.5 per cent, thus giving the patient three chances out of four. When one realizes that the disease is 100 per cent fatal, the operative risk must be considered remarkably low. As to the end-results of these cases, 55 per cent of those who survived operation, lived and remained in good health for more than 15 months and may be considered cured.

Banti's disease, as seen clinically, usually presents the picture of enlarged spleen, gastric hæmorrhages, a complicating portal cirrhosis, ascites, then death. As to the cause, at present it is a hypothetical question, and the very absence of known etiology stamps the syndrome as a very difficult one to differentiate from several other splenomegalic conditions; suffice to say, that if there is a history of primary splenomegaly before liver enlargement, together with the other symptoms mentioned above, then one may safely assume that he has to do with a Banti's disease or primary splenic anæmia as some prefer to call it.

Pathologically, the typical blood picture shows a diminution of red cells, and hæmoglobin, a leucopenia, diminished platelets, and a severe secondary anæmia as exemplified by anisocytosis, achromia and poikilocytosis. The spleen itself is hypertrophied, the chief new element being an increase in the connective tissue; the capsule is slightly thickened, adherent, and strips with difficulty. The pulp and malphigian bodies are atrophied, being replaced and surrounded by dense fibrous tissue.

FUNCTION OF NORMAL SPLEEN

The function of the normal spleen certainly is not one necessary to the well-being of the individual, for no untoward effects have followed its removal. Various observers have maintained that it has some connection with the regulation of the supply of the red blood corpuscles; it has been supposed to be an organ for the destruction of the red blood corpuscle; it has been suggested that the spleen is concerned in the production of uric acid. Jones and Austrian have shown that the spleen contains the enzymes adenase, guanase, and xanthin oxidase which act upon the split products of the nucleins and convert them into uric acid. Lee and Minot contend that a diseased spleen inhibits normal bone marrow function, and the removal of such a spleen removes this inhibition stimulating this bone marrow function; that it stimulates all lymphatic tissue; that it causes the red blood cells to be more resistant to hæmolysis, and that they become less fragile. Maurizio Bufalini, investigating the number of bacteria in bile after splenectomy in animals, found fewer organisms than in normal controls. Ten days after operation, there were fewer organisms circulating in the blood than before operation. In spite of the trauma inflicted, there is increased resistance in young animals, and the red blood cells are increasingly resistant to hypotonic salt solutions.

RESULTS OF SPLENECTOMY

After splenectomy, there is a loss of iron from the body, which would lead one to believe that the spleen functionates in some manner in the regulation of metabolism either in iron conservation lost in blood destruction, or in the manufacture of hæmoglobin, or in the formation of the red blood cells. Changes following removal of the spleen for chronic conditions are less marked than those resulting from removal of apparently healthy spleens due to acute conditions, as traumatic rupture, probably due to the fact that in chronic cases compensation for lost splenic function is gradually being built up, so that further changes after splenectomy are less noticeable. The chief changes are enlargement, temporarily, of the lymph glands, development of new hæmolymph nodes, secondary anæmia, leucocytosis, relative lymphocytosis, and late eosinophilia.

As to what really constitutes a cure, is indeed a moot question. Cushing's case is perhaps the most famous, being at the same time the first case in this country ever

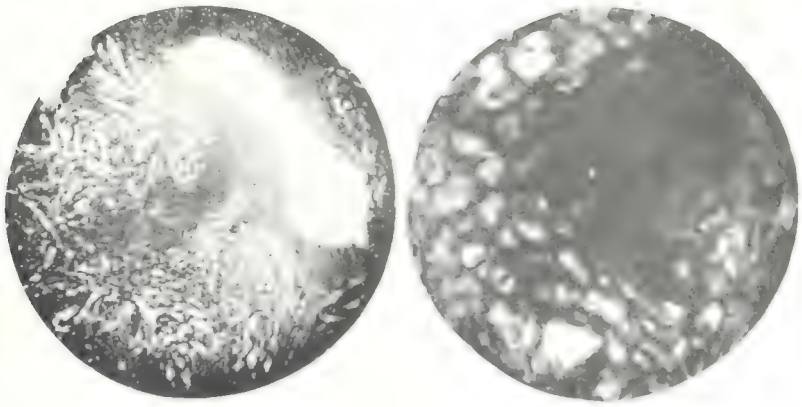

Fig. 1. Case 1, low power.

splenectomized for Banti's disease, and likewise the longest lived. The patient is still alive after 23 years, and occasionally has an attack of hæmatemesis, but seems to be free from ascites. In spite of this splendid result, Cushing himself is not so sure as to how much relief he gave the patient, and advises caution in judging the ultimate results of splenectomy.

Banti's disease, although it has periods of quiescence, will eventually terminate in death, usually due to intercurrent hæmatemesis. What splenectomy really does for the patient is conjecture only, the feeling of W. J. Mayo in the matter being that removal of the spleen not only cuts off a possible supply of toxic material from the general circulation, but also reduces the portal circulation about 25 per cent, and the ultimate result of the operation depends upon whether or not the liver has sufficient cells to carry on its function.

Hence, after all is said and done, to ascertain actually how beneficial splenectomy really is in these conditions, it is absolutely necessary that every case so diagnosed should be reported in great detail, that others may deduce how much stress to place upon this procedure. This is my only excuse for reporting the two following cases.

I feel certain that our two cases are typical Banti's disease; the history, clinical and laboratory findings being so conclusive as to rule out all other conditions characterized by splenomegaly, ascites, etc. In both cases, the patients were of more than average intelligence, and gave a detailed description of the onset and course of their disease, both distinctly felt pain and tumor mass in the left upper quadrant long before any symptoms occurred referable to the right side, both were their own clinicians for a period of a year or more. Previous examinations of these two men made many times by competent clinicians always resulted in the same diagnosis, the spleen alone being found enlarged. After a very thorough investigation in all branches, no etiology was found that could explain the clinical and laboratory findings, and after complete abdominal exploration, the causative factors are still unexplainable.

Case 1. Mr. P. G. entered the National Military [illegible] and well. Four brothers are living and well. No brothers or sisters are dead. No family history of tuberculosis, cancer, insanity, or alcoholism. No [illegible] rlet fever, pneumonia, influenza, pleurisy, malaria, typhoid, or tuberculosis. Cardio-[illegible] at which time he began to experience a dull, drag-[illegible] immediately reported to the medical director, and [illegible]

intensive syphilitic course including salvarsan injections and mercury by mouth. He palpated his own abdomen daily and noticed the gradual increase in the size of the mass on the left side. One year after this he felt a dragging sensation of pain in the right upper quadrant, and upon palpating his own abdomen, he felt a mass there. His jaundice remained. Repeated blood tests still showed a 4+, and the antisyphilitic treatment was continued until admitted, and after his discharge, he was intensively treated by his family physician. Both masses gradually increased in size, but the pain now disappeared.

Three months ago, while receiving an intravenous injection of salvarsan, he vomited about 3 pints of blood, which incident he ascribed to the injection. He steadfastly denied ever having had any venereal disease, and never had any sexual intercourse until long after they had secured a positive blood test on him in the army. He was very frank and honest about this, since he realized the gravity of his condition, and desired to do all in his power to assist his physician in arriving at a correct diagnosis. Since his first attack of hæmatemesis, he has had two others, 1 of a pint, and the other a little over a pint of bright red blood.

Six weeks ago, he was tapped, and about a gallon of straw-colored fluid was obtained. Four weeks ago, he noticed that his abdomen was protruding, becoming more tense and heavy, and he could no longer feel the masses which he knew nevertheless must be present. This frightened him and caused him to enter the hospital.

He was poorly developed and nourished; height, 66½ inches, present weight 112, average weight 145. Temperature 98.8°, pulse 84, respiration 20. The skin was generally jaundiced of brownish yellow color. No scars or eruptions. The head is symmetrical, no exostoses or points of tenderness. The pupils are equal, regular, react to light and distance. No nystagmus, strabismus or ptosis. Motions of eyeballs normal. Scleræ jaundiced. Vision normal. The ears show no tophi or discharge. Hearing normal. No mastoid tenderness. The nose shows no perforation or deviation of septum. No nasal obstruction. The mucous membranes of the throat are of good color. The teeth are good, the tonsils enlarged. There are no palpable glands of the neck, no thyroid enlargement, no suprasternal pulsation or tracheal tug. The chest is symmetrical, expansion equal. There is normal vesicular resonance throughout right lung, flatness in mid and posterior axilla from sixth rib down on left side. Diminished breath sounds, diminished tactile and vocal fremitus over this area. No râles. Point of maximum impulse not seen or felt. Right border of dullness 2 centimeters to right of mid-line. Left border not outlined due to merging of axillary flatness. Soft blowing systolic murmur heard best at the apex, not transmitted. Pulses equal, regular of good volume and tension. Blood pressure 110—80. The abdomen is full, round, protuberant, the umbilicus flattened. The veins of the abdomen are prominent. Fluid wave and shifting dullness are present. On deep palpation, a large mass descending with respiration is felt on the left side. The borders mapped out extend from sixth rib in axillary space down to the crest of the ilium, and inward to umbilicus. Edge not felt due to fluid present. Liver felt 3 centimeters below the costal border. The genitalia show no scars, hernia, or hæmorrhoids. The reflexes are present and normal. Muscular system negative. Rectal examination negative.

Laboratory findings

Blood:

Hæmoglobin	60 per cent
Red blood cells	3,200,000
White blood cells	3,300
Polymorphonuclears	62 per cent
Small mononuclears	34 per cent
Large mononuclears	2 per cent
Nucleated reds	2 per cent
Platelets diminished coagulation time	4 min.
Wassermann	4+
Blood group	two
Smear shows achromia, anisocytosis, and poikilocytosis	No bile

Urine: Clear, dark, amber; specific gravity 1024; no albumin, sugar, or sediment. Bile present.

Fæces: Stools dark brown, well formed, no ova or parasites. No gross or occult blood.

Diagnosis: Banti's disease.

In spite of the positive Wassermann, we felt that we were dealing with a case of Banti's disease, and not one of syphilis. A positive Wassermann in the presence of jaundice is not of great significance, and it has been within nearly everyone's experience to encounter this. Consultation with the genito-urinary department resulted in the same opinion, for they felt that a persistent 4+ in the face of intensive syphilitic treatment could hardly exist without any other external stigmata or symptoms of syphilis. R. C. Cabot, in a personal communication, in discussing the jaundice in this case, felt that the Wassermann test might easily be explained by it. As to the cause of a positive Wassermann in the presence of jaundice, syphilographers are still at sea. McDonough is of the opinion that the jaundice acts upon the lymphatic cells which in turn set free antigens which fix the complement, giving a false positive, and may continue to do this long after the jaundice has cleared up. If this is so, it is very difficult to explain why every case of jaundice does not give the false test; why only

certain types of jaundice will give it. Nevertheless, it is a fairly common clinical observation and it must be admitted that we went ahead with a certain degree of trepidation, still holding steadfastly to the diagnosis of Banti's disease. Consultation with E. R. Arn, M.D., F.A.C.S., and Colonel Mattison, M.D., F.A.C.S., only served to strengthen our conviction. Subsequent events proved that we were correct.

Operation. Splenectomy was performed July 8, 1921. On opening the abdomen, a large quantity of straw-colored fluid escaped. A collected sample showed a specific gravity of 1010. The liver was hypertrophied, the edges and surfaces hobnail in type. The gall bladder was negative. The spleen was dark red in color, edges smooth, surrounded by adhesions, and filled half of the abdomen. The adhesions were thickest about the gastrosplenic omentum, and in denuding the gastric area, a raw surface was left. The spleen measured 25 by 12 by 3 centimeters and weighed 1162 grams.

Pathological Report. Section of the spleen shows marked increase in fibrous tissue and marked congestion of the veins, which were tremendously dilated. There were no malphigian corpuscles visible.

Postoperative history. Patient took the anæsthesia very well, and made a good rapid ether recovery. Although the pulse was full and bounding, he was given 750 cubic centimeters of normal saline with gum arabic intravenously, and [illegible] cubic centimeters soda-bicarbonate with glucose by Murphy drip. The temperature for the first 2 days ranged from 99 to 100.2, then fell to normal and remained there. His convalescence from that point on was entirely normal, and in 14 days he was out of bed. Blood examination at this time showed:

Hæmoglobin	50 per cent
Red blood cells	2,800,000
White blood cells	8,200
Polymorphonuclears	54 per cent
Large mononuclears	[illegible] per cent
Small mononuclears	20 per cent
One reticulated red cell.	
Wassermann	3+

Fourteen days after operation he weighed 110 pounds. He remained with us 2 months, and upon leaving, his weight had increased to 131 pounds. Blood examination was as follows:

Hæmoglobin	75 per cent
Red blood cells	[illegible]
White blood cells	10,200
Polymorphonuclears	49 per cent
Large mononuclears	32 per cent
Small mononuclears	[illegible] per cent
Eosinophils	2 per cent
Wassermann	1+

The patient had not had any antisyphilitic treatment since entering the hospital; his jaundice had entirely cleared up by this time, the liver border [illegible] centimeters further down than [illegible] operat[illegible]

By request, the patient reported back to the [illegible] daily, 6 days a week. His weight is now 130 pounds, no jaundice or ascites are present. There is tenderness over the liver area, and the lower edge is still palpable. [illegible] Blood [illegible]

Hæmoglobin	[illegible]
Red blood cells	[illegible]
White blood cells	[illegible]
[illegible]	[illegible]
Large [illegible]	[illegible]
Small mononuclears	27 per cent
[illegible]	[illegible]
Wassermann	[illegible]

He has not had any hæmatemesis, epigastric [illegible] comfort, or pyrosis, since operation. His appetite is excellent, he sleeps well, and carries himself with the utmost of comfort.

November 11, 1921. General condition excellent. No [illegible] symptoms of any nature.

Blood:

Hæmoglobin	90 per cent
Red blood cells	5,096,000
White blood cells	9,800
Polymorphonuclears	44 per cent
Large mononuclears	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Eosinophiles	5 per [illegible]
[illegible]	[illegible]

January 6, 1[illegible]

Blood:

[illegible]	[illegible]
Red [illegible] cells	[illegible]
White [illegible]	[illegible]
Polymorphonuclears	26 per cent
Large lymphocytes	55 per cent
[illegible]	[illegible]
[illegible]	[illegible]
Eosinophiles	2 per cent
[illegible]	[illegible]
Wassermann	negative

His [illegible] or hæmorrhages. Liver 4 centimeters below. Slight epigastric tenderness at times.

It will be agreed, I believe, that, as far as the period of observation goes in this case, it can be regarded as an apparent cure. I say apparent, because I do not believe that 6 or 7 months' observation in a condition of this kind should warrant one in drawing a definite conclusion. Personally, I feel that reports of all such cases should be published

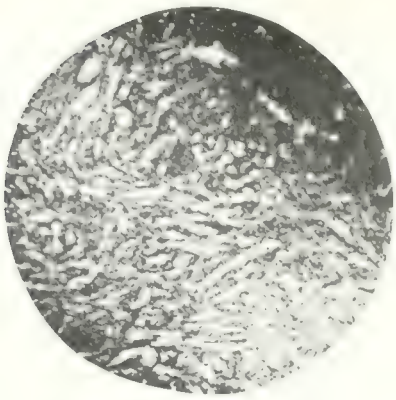

Fig. 3. Case 2, low power.

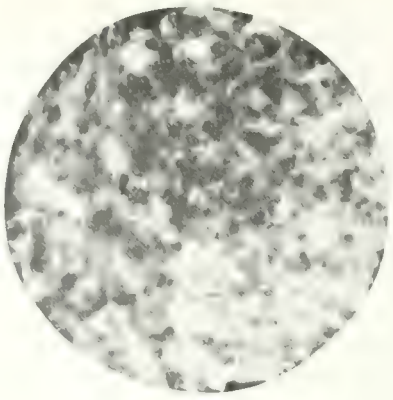

Fig. 4. Case 2, high power.

as soon as possible, and for that reason I have recorded this a little earlier than is customary. A further history of this case will be published in conjunction with another case of Banti's disease now in the wards.

The second case reported here, unfortunately, did not terminate so happily as the previous one. His condition had gone on so far, that paracentesis was necessary every 4 or 5 days, every one of which necessarily weakened him still further. He was a very poor operative risk, and it might be argued that poor judgment was shown in subjecting to operation at this stage. This point was the subject of a heated discussion at a staff meeting, and it was felt that if left alone, he had absolutely no chance, and humanity alone decreed that he was entitled to whatever chance operation afforded, meager though it was. The entire matter was explained frankly to the patient who was quite an intelligent person, and he gladly accepted the last opportunity to attempt to check his malady.

Case 2. Mr. R. C. F. entered the National Military Hospital June 15, 1921. Age 27, height 67 inches; normal weight 165, now 140. Pulse 84, of fair volume and tension. Respiration 20. Temperature 98.8°. The family and past history are unimportant. Patient felt perfectly well until 4 years ago, at which time he noticed a large mass on the left side of the abdomen. Previous to this time he remembers having had a dull dragging pain in that region. He consulted a physician who told him that he had a large spleen, and ought to undergo an operation, which he refused. He went on this way for 2 years, when he became troubled with dull epigastric pain. Eighteen months ago he vomited about 3 pints of blood, and after this, remained in bed for 2 weeks. Two months after this hæmorrhage, his abdomen became greatly "swollen," and he consulted a physician who tapped him and secured 2 gallons of fluid. He was again advised to have his spleen removed, but refused to do so. Since then, fluid has been withdrawn eleven times, each time with varying amounts of fluid. One month ago he decided to have his spleen removed, and consequently entered this hospital.

The skin showed generalized jaundice of deep brown color. Scleræ jaundiced. Physical examination was practically negative with the exception of the abdomen.

The abdomen was full, round, with umbilicus flattened. The abdominal veins were very prominent. Large fluid wave and shifting dullness were present. Further palpation was impossible. On tapping, seven quarts of straw-colored fluid were removed, specific gravity 1012, albumin, 1 per cent. Palpation now disclosed a large mass in the left flank extending as far as the umbilicus in the midline. This mass moved with respiration. Liver palpable 2 centimeters below costal border.

Blood showed:

Hæmoglobin	50 per cent
Red blood cells	2,700,000
White blood cells	3,700
Polymorphonuclears	62 per cent
Small mononuclears	36 per cent
Large mononuclears	2 per cent
Platelets diminished.	
Smear shows achromia, anisocytosis, and poikilocytosis.	
Wassermann	negative
Coagulation	6 minutes
Group	4

The urine was acid, dark brown, 1024, no albumin or sugar or sediment. Bile present.

The fæces showed stools well formed, light yellow, no ova, parasites, gross or occult blood. Patient was again tapped seven days after admission, and 5 quarts of fluid similar in nature to the above was removed.

Operation: Splenectomy. [illegible] June 7, 1921. On opening the abdomen, large quantities of fluid escaped. The liver came down to the costal border, was very cirrhotic and deformed. The spleen filled the entire left half of the abdomen, was adherent to the surrounding structures, and was removed with great difficulty. The patient left the operating room in shock; was immediately transfused with normal saline in gum arabic, and given fluids by rectum. Twelve hours later, he suddenly became pulseless and died. Postmortem examination was refused. Size of spleen [illegible] centimeters and weighed 1284 grams.

SUMMARY

1. Splenectomy has come to be a common surgical procedure, and is now indicated in any condition characterized by splenomegaly, with or without enlargement of the liver and ascites.

2. Splenectomy in Banti's disease affords the only means of relief or cure. Judgment as to its ultimate value in this condition should be cautious until sufficient number of cases are on record with adequate follow-up reports, and with this in view, a plea is made for detailed reports of all cases so diagnosed.

3. A summary of the literature of the past 20 years shows thirty cases reported, in which the etiology was unknown.

4. Two cases of Banti's disease in the terminal stage are reported, one case giving a positive Wassermann which was due to jaundice, and which resulted in an apparent cure after splenectomy, the patient being free from all symptoms six months and one week, after operation.[1] One case died [illegible] hours after operation.

[illegible] tion of this manuscript.

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CANCER OF THE PROSTATE

A Comparison of Results Obtained by Radium and Surgical Treatment

BY HERMON C. BUMPUS, [illegible]

IN order to form a judgment of the results following the use of radium in the treatment of malignancy, they are usually compared with those formerly obtained by surgery, the unit of measure being the number of patients who have lived free from symptoms an arbitrary number of years after treatment. Such a method of comparison allows a wide margin of error, unless the patients treated by radium are in approximately the same general condition as those treated by surgery. Obviously this is seldom the case; radium has a greater field of application than surgery, as it is often employed when the general condition of the patient or the extent of the disease would not permit surgery. This fact not only renders [illegible] comparisons difficult, but is the greatest single factor in the development of false ideas regarding radium therapy. This [illegible] prostate, since in 28 per cent there is metastasis to the bones when the patients are first examined. A large number of others have glandular metastasis or evidence of considerable local extension; many are [illegible]

physical condition that death is soon inevitable and treating them by radium obviously places on this form of therapy an undeserved stigma. In an earlier publication I called attention to the fact that radium treatment is recommended in less than 50 per cent of patients with carcinoma of the prostate who are examined at the Mayo Clinic. Until routine yearly physical examinations, such as are conducted by the life extension institutes, become more general, I doubt that this disease will be discovered in time to institute early treatment, for carcinoma of the prostate often becomes very extensive and even metastasizes before urinary symptoms call attention to its presence.

Before 1915, when radium was first used in the Mayo Clinic, patients with carcinoma of the prostate who were in sufficiently good physical condition were operated on. The operations were similar to those performed at that time for benign hypertrophy. The so-called radical operations which often damage the sphincters of the bladder to some extent were not attempted because the resulting incontinence usually caused greater distress than the malignant condition. Since 1915, only patients in whom the malignancy was so slight that a definite diagnosis could not be made have been referred for operation. They were advised to have operations rather than radium treatment in the hope that if incipient cancer were present it might be removed completely.

Besides the patients on whom operations were performed before and after the advent of radium, there were those in whom malignancy was not suspected until discovered by the pathologist after the removal of a supposedly benign gland. These patients, and those operated on because of suspected malignancy of the prostate will be referred to as *early cases*. There are seventy-two patients in this group. Patients in whom the disease was so far advanced as to render clinical diagnosis certain will be referred to as *advanced cases*. There were seventy-seven patients in this group.

It would naturally be supposed that patients in whom early malignancy either escaped detection completely or was only suspected would obtain better results from surgery than those in whom the neoplasm had progressed so that the diagnosis was beyond question. Nevertheless, there is little difference in the final results in the two groups. In the advanced cases, 35 per cent of those who died succumbed within the first year, while in the early cases 34 per cent of those who died succumbed the first year. The average length of life of patients in the first group was twenty-six and sixteen hundredths months following operation, of the second group, twenty-seven and twenty-eight hundredths months. In both groups only 9 per cent of those who died had lived more than three years.

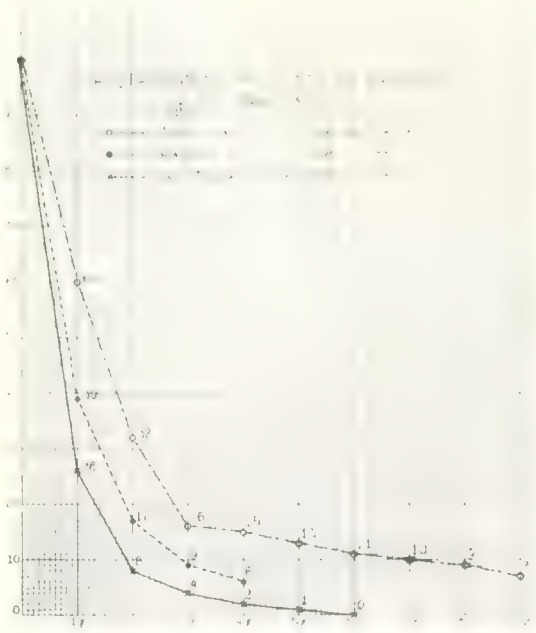
The mode of operation would not seem to be a factor in results, as the perineal and suprapubic operations were employed about equally in both groups. There were twenty-three perineal and forty-five suprapubic operations in the first group and twenty-two perineal and thirty-four suprapubic in the second group. A reclassification according to the method of operation indicates slightly better results from the suprapubic approach. The average duration of life of the forty-five patients who had perineal operations was twenty-five and seventy-eight hundredths months. Seventy-one per cent died during the first two years. The average length of life of the seventy-nine patients who had suprabubic operations was twenty-eight and eighty-five hundredths months; 66 per cent died during the first two years. Eleven per cent of the first group and 20 per cent of the second group lived more than three years. It would seem, therefore, that neither the method of operation nor the extent of the malignancy up to the point of operability is the determining factor in the results obtained.

I have called attention to the fact that microscopic findings of the relative degree of malignancy is the determining factor in the prognosis. If the malignant cells are partly differentiated, are fairly regular in size and shape, and retain the characteristic, long tufted ends, the outlook is much more favorable with regard to subsequent duration of life than if the malignancy is slight, but the cancer cells show little or no tendency to

simulate the normal type and occur irregularly dispersed throughout a fibrous tissue stroma.

In order to compare results of operation with those obtained by the use of radium, all the surgical cases, irrespective of the extent of malignancy at the time of operation or the method of operation, should be placed in a single group. Thus 124 patients with partial prostatectomies for carcinoma are compared with 152 treated by radium. The 124 patients comprise all those operated on, irrespective of the extent of the malignancy or the amount of malignant tissue removed, and the 152 patients treated with radium represent all forms of radium treatment administered in all stages of the disease, except when metastasis was demonstrable.

In making such a comparison it must be remembered that most of the operative work had been done more than six years before, while the radium treatment had all been given in the last six years. Therefore, greater length of life has been afforded patients treated surgically than those treated by radium. Moreover, during the first half of this six-year period radium therapy was largely in the experimental stage, and as yet has not wholly emerged from this stage. Only during the past three years have patients been wisely selected and adequately treated with radium. Formerly, it was believed that radium applied over the surface of the prostate either in the rectum or urethra was sufficient, and failure was attributed to inability to penetrate the mucous membrane with sufficiently large doses. To overcome this obstacle, needles containing radium were inserted through the perineum directly into the growth, and large doses were given. This resulted in necrosis and sloughing around the needles, but the periphery of the gland received but scant radiation. In order to radiate the entire lesion sufficiently it is necessary to use all methods of application with minimal doses of radium. The number of points from which radiation is directed becomes as important as the dosage. It is only during the past three years that this fact has been recognized, and the end results are not yet demonstrable as are those of surgical procedures instituted



six years before. Moreover, patients treated by surgery represent a picked group whose physical condition permitted major operations, while those treated with radium represent very poor risks, and many would not now be given the radium treatment. Therefore, any but a very marked advantage in results in the surgical group may be attributed to the more favorable general condition of such patients.

If it is considered that the patients who died are completed cases, 106 such patients in the surgical group, and 118 in the radium group are dead. In the surgical group the average length of life was twenty-one and sixty-seven hundredths months, in the radium group twelve and thirty-six hundredths months. This difference of approximately ten months in favor of the surgical cases is apparently owing to the better physical condition of the patients at the time of operation rather than to the results of surgery. Successful surgery should have prolonged life more than ten months beyond the average for radium treatment. In the surgical group 69 per cent died during the first two years; in the radium group 83 per cent, a difference of 14 per cent in favor of surgery attributable to the same cause.

In [illegible] patients with carcinoma of the prostate who were examined at the Mayo Clinic and not treated, I found the average duration of the disease to be thirty-two months from first symptoms to death; they lived an average of ten months following examination. In the surgical group the duration of the disease averaged fifty-seven months, and the patients lived an average of twenty-seven months after operation. In the radium group, because of recent treatments, such a comparison would obviously be misleading. However, it is interesting to note that the twenty-nine living patients treated by radium prior to January, 1921, average twenty-eight months of life after treatment, and that the average duration of their disease has been prolonged to fifty-eight months. These are approximately the same averages as those obtained in the surgical group. From the chart it may be noted that 17 per cent of the patients treated with radium have lived more than two years after treatment, the period during which 92 per cent of untreated patients died. It is also interesting to note that while there are over twice as many patients, treated surgically, alive at the end of each year as there are of those treated by radium, still there are twice as many of the latter alive as there are untreated patients.

The efficiency of surgery is best portrayed by the fact that after six years all untreated patients are dead, while 11 per cent of the patients treated surgically are living, and at the end of nine years 9 per cent are still alive. This shows that it is possible occasionally to remove all the malignant cells by conservative surgery. Radium is applicable to a greater percentage of cases than surgery, and in these will increase the duration of life. In a small percentage, results equal to those following surgery will be produced. A combination of the two methods would seem to be the procedure of choice.

In combining the two methods, radium should be used before surgery, minimal doses being given from as many points of entry as possible in order to insure complete radiation of the gland and thus render the cancer cells incapable of reproduction. Even if the cells are forced beyond the prostatic areas as a result of enucleation of the growth they will be incapable of multiplying. If sufficient doses of radium are given to be effective after the removal of the gland, there is danger of producing a vesicorectal fistula.

CONCLUSIONS

1. The results obtained thus far by radium in the treatment of cancer of the prostate are inferior to those obtained by surgery.
2. The new methods of radium application indicate that in the future the results of the two methods will be the same.
3. Partial prostatectomy in cases of carcinoma occasionally proves to be a curative rather than a palliative procedure.
4. A combination of radium and surgery offers the best results.

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LEUCOCYTOSIS FOLLOWING GYNECOLOGICAL OPERATIONS

Report of 50 Gynecological Cases, With Record of Interval Postoperative Leucocyte Counts

By R. A. SCOTT, M.D., Evanston, Ill.

LEUCOCYTOSIS, following surgical operations, has been a subject of discussion by a number of men, namely: Herbert King, 1899; White [illegible]; R. C. Cabot, Blake, and Hubbard, 1901; Frazer and Halloway, 1901; Da Costa and Kalteyer, and Charles Gibson, 1906. Cabot, Blake, Hubbard, and Da Costa, laid special emphasis on the immediate and but temporary rise in the white blood cells after the administration of ether, which, I believe, has no important bearing on the present series, for there were no counts made during the convalescence. White, in 1900, reported a series of 25 gynecological cases, emphasizing the postoperative changes in the white cells; the morphology of the leucocytes, the types of cells and their granules, and the relative and absolute increase of the polymorphonuclear neutrophiles, denotes either a normal reaction toward convalescence or a blood picture of the onset of a peritonitis. These observations are certainly very important, and of great diagnostic and prognostic value.

The above papers dealt with the morphology of the white cells and the temporary leucocytosis following ether anæsthesia. We shall in this paper endeavor to throw some light on the following questions:

1. Is it possible to say, that, on a certain day after a certain type of gynecological operation, in a previously non infected case the leucocytosis should reach a certain average height?

2. And in another or same type of case, that has had a previous focal infection in the pelvis with subsequent operation, can one rely on a certain average increase or decrease of the white cells?

3. Can we take for granted that there will be a certain rise of white cells and a certain decrease of them, after a number of days, in a previously non-infected case, for example, following a hysterectomy, for the removal of multiple fibroids, or can we apply the same question following a perineorrhaphy?

These questions have come to my mind, from time to time, during discussions which have arisen when a certain surgical or gynecological case under postoperative observation, has developed a sudden rise in pulse and temperature together perhaps, with some abdominal pain. In an effort to solve the problem and not primarily for diagnosis [illegible]. For example, on the third day the white count is 18,000. The surgeon asks what leucocytosis one could expect at this stage of convalescence following such a type of operation? No one seemed sufficiently informed to be able to answer the question correctly.

In the cases herein observed, we have endeavored to make the same blood cell counts at certain intervals during convalescence. As near as possible, the counts were made at a certain time each day and by the same man.

The cases are divided as follows:

I. Thirty mixed cases which, as far as we could ascertain, had no focal infection in or out of the pelvis.

A. Ectopic P[illegible]
   a. Unruptured
   b. Ruptured . .
B. Hysterectomy 14
   a. Fibroid uteri
   [illegible]
   case, and high cervical lacerations, in
   [illegible]
C. Moderate procidentia, with relaxed perineum and cystocele -retroversion in three
D. Ovarian cysts. . . . . .
E. Lacerated perineum with anal fistula
F. Colporrhaphy and perineorrhaphy

II. [illegible]
in the pelvis.

A. H[illegible]
   of cervix and [illegible]
B. Vaginal h[illegible]
   ectomy
C. H[illegible]

TABLE I—WHITE CELL COUNT IN CASES OPERATED ON WITH NO PREVIOUS GENERAL OR LOCAL INFECTION

		Pre-op.	1st P. O.	3rd P. O.	5th P. O.	7th P. O.	10th P. O.
[illegible]	[illegible]	[illegible]	[illegible]	7,900	6,850	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	9,050	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	9,400	[illegible]	8,000
Ruptured ectopic pregnancy	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Ruptured ectopic pregnancy	Left salpingo-oophorectomy	1,450	13,800	12,350	11,280	9,950	9,000
[illegible]	Supravaginal hysterectomy. Right salpingo-oophorectomy	6,800	12,350	7,950	7,050	6,650	7,000
[illegible]	Hysterectomy	5,850	13,000	11,750	8,050	13,150	10,950
[illegible]	Hysterectomy	6,300	9,100	7,500	7,200	7,200	7,100
Uterine fibroid	Hysterectomy	8,800	13,650	10,950	8,750	10,300	9,400
Fibroid (subserous)	Hysterectomy	5,000	11,200	9,800	8,700	7,200	7,200
Uterine fibroid	Hysterectomy	6,300	15,000	9,600	8,000	7,200	8,200
[illegible]	Hysterectomy, salpingo-oophorectomy, perineorrhaphy	8,900	19,950	12,500	11,350	10,650	10,150
Laceration of cervix, 3rd degree re-	Hysterectomy	7,100	14,880	13,700	13,150	11,000	11,050
Uterine polyp	Hysterectomy	7,000	8,800	7,600	8,000	8,000	8,200
[illegible]	Hysterectomy and repair of rectocele	1,800	13,400	9,800	9,000	8,600	8,900
Prolapse of uterus	Ant. colporrhaphy; perineorr., hysterectomy, bilateral salpingo-oophorectomy	8,800	10,000	9,000	9,600	7,600	7,000
Procidentia	Hysterectomy and perineal repair	10,000	11,600	12,400	10,300	7,800	7,200
Procidentia, retroflexion, laceration of cervix	Hysterectomy, repair of cervix and rectocele	8,000	23,000	10,600	13,000	8,400	6,000
Prolapse of uterus, cystocele, and relaxed perineum	Anterior vaginal wall repaired, suspension of uterus	5,150	10,600	9,750	9,200	9,100	8,500
Lacerated cervix, cystocele, rectocele	Dilatation and curettement, perineorrhaphy, colporrhaphy, anterior fixation of uterus	7,750	16,500	10,050	11,900	10,000	9,200
Relaxed perineum, retroversion	Ventral suspension, perineorrhaphy, resection of uterus, ends of tubes	6,800	10,800	16,500	8,950	9,250	9,000
Relaxed vaginal outlet retroversion	Perineorrhaphy, resection of tubes, uterus suspension	9,100	18,350	13,850	10,550	9,350	9,600
Retroversion and relaxed perineum	Perineorrhaphy, Coffey round-ligament plication	8,700	14,050	9,200	9,050	8,650	8,400
Mild procidentia with cystocele	Olshausen suspension of uterus	8,250	17,450	15,350	11,100	11,650	9,200
[illegible]	Removal of cyst	7,500	13,850	9,200	6,600	6,000	7,000
Left ovarian cyst, pregnancy	Removal of cyst	9,000	11,000	10,600	9,600	9,000	6,600
Ovarian cysts, retroversion; relaxed perineum	Hysterectomy, bilateral oophorectomy, perineor	8,900	12,500	9,900	8,200	8,200	7,400
[illegible]	Excision of cyst and ovary and right tube and small cyst of left ovary	9,003	10,200	10,500	8,600	7,300	8,300
Cystocele and rectocele	Colporrhaphy and perineorrhaphy	7,250	14,450	16,700	9,550	7,750	7,200
Lacerated perineum with anal fistula	Perineorrhaphy	7,800	11,000	10,650	10,000	10,000	8,000

D. Uterine suspensions, 2 Webster-Baldy—myomectomy in one, and right salpingectomy in the other; one Coffey plication, and repair of cervix and perineum . . . 3

E. Dilitation and curettement; endometritis and perineorrhaphy and excision of uterine cyst 2

F. Panhysterectomy, carcinoma of the cervix 1

G. Exploratory laparotomy, with removal of section of the tumor for diagnosis; carcinoma of right ovary and omentum 1

III. One diathermy treatment of tumor through cystotomy: carcinoma of the bladder.

TABLE II—WHITE CELL COUNT IN CASES OPERATED ON WITH HISTORY OF PREVIOUS INFECTION IN PELVIS

		Pre-op.					
Bilateral salpingitis	Hysterectomy, bilateral salpingo-oophorectomy						
Bilateral salpingitis	Hysterectomy, bilateral salpingo-oophorectomy						
Bilateral pyosalpingitis	Hysterectomy, bilateral salpingo-oophorectomy						
Chronic salpingitis, retroversion uterus	Hysterectomy, left salpingo-oophorectomy		19,000				
Bilateral pyosalpinx, ovarian cyst	Hysterectomy, removal right ovarian cyst, bilateral salpingectomy						
Bilateral pyosalpinx, dysmenorrhœa	Hysterectomy, bilateral salpingo-oophorectomy						
Chronic salpingitis, retroversion uterus	Right salpingectomy, Webster-Baldy suspension						
Left salpingitis, right tubo-ovarian abscess	Hysterectomy, bilateral salpingo-oophorectomy						8,250
Left ovaritis, sigmoid adhesions	Hysterectomy, bilateral salpingo-oophorectomy						
Infected uterus, multiple fibroids	Hysterectomy		10,800				
Fibroid salpingitis, lacerated cervix and perineum	Trachelorrhaphy and perineorrhaphy, hysterectomy, right salpingo-oophorectomy		20,000			10,000	7,300
Fibromyoma and relaxed perineum	Removal of fibroid, Webster-Baldy suspension, perineum repair					14,200	
Fibroid of uterus, right cystic ovary	Hysterectomy, right salpingo-oophorectomy						
Retroversion, lacerated cervix, erosion, relaxed perineum	Removal cervix perineorrhaphy, resection of ovary, Coffey fixation						
Pelvic peritonitis, vaginitis	Subtotal hysterectomy, bilateral salpingo-oophorectomy						
Endometritis, vaginal discharge	Dilatation and curettement						
Endometritis, relaxed perineum	Dilatation and curettement, perineorrhaphy, evacuation of uterine cyst						
Endometrial pedunculated fibroma protruding from cervix	Vaginal hysterectomy and supravaginal hysterectomy	8,400				Death	
Fibroid of uterus with carcinoma of cervix	Panhysterectomy						
Carcinoma of right ovary and omentum, cystic left ovary	Exploratory operation with removal of cystic ovary for diagnosis						
Fibroid of uterus	Hysterectomy						
Carcinoma of bladder	Hysterectomy, implantation of ureters into sigmoid						

I will list the daily counts following the individual operations making a general division between cases operated upon with a history of no previous infection, and those with a history of previous infection, which as far as could be ascertained at time of operation, had subsided (Tables I and II).

In Table III I have included the average temperature, simply to show that there is no constant comparison between the rise and fall of the temperature and leucocyte count. In the average counts of the tubal pregnancies we have the usual rise in white blood cells due to pregnancy. In the ruptured tubal pregnancies, we have the usual rise, plus the rise, as a result of the absorption of free blood in the abdominal cavity.

There is, in the series shown in Table IV also, the lack of constant ratio between the postoperative temperature and leucocytosis.

TABLE III.—EXCISION OF TUBE AND OVARY IN FIVE CASES OF ECTOPIC PREGNANCY WITH NO PREVIOUS INFECTION

	Temperature	White cell count
[illegible]	[illegible]	[illegible]
[illegible]	98.8	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
5 days after operation	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Ruptured ectopic pregnancy—3 cases		
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
12 days after operation	98.6	[illegible]

The average counts listed here are rather interesting and practically constant, there being less than 2,000 cells difference between these separate lists of averages, on corresponding days, although the uteri were removed because of 4 distinct varieties of causes.

TABLE IV.—AVERAGE TEMPERATURE AND WHITE BLOOD COUNT IN FOURTEEN HYSTERECTOMIES WITH NO PREVIOUS INFECTION

	Temperature	White cell count
Fibroid of uterus—7 cases		
1 day before operation	98	6,707
1 day after operation	98.4	[illegible]
3 days after operation	100.4	[illegible]
5 days after operation	[illegible]	[illegible]
7 days after operation	[illegible]	[illegible]
12 days after operation	[illegible]	[illegible]
Procidentia—4 cases		
1 day before operation	98	7,900
1 day after operation	100.4	14,500
3 days after operation	[illegible]	[illegible]
5 days after operation	[illegible]	[illegible]
7 days after operation	[illegible]	[illegible]
12 days after operation	[illegible]	[illegible]
Retroversion—2 cases		
Ovarian cyst, high cervical laceration		
1 day before operation	98	8,000
1 day after operation	99.4	13,675
3 days after operation	[illegible]	[illegible]
5 days after operation	[illegible]	[illegible]
7 days after operation	[illegible]	[illegible]
12 days after operation	98.6	9,775
Uterine polypi—2 cases		
1 day before operation	[illegible]	[illegible]
1 day after operation	[illegible]	[illegible]
3 days after operation	[illegible]	[illegible]
5 days after operation	[illegible]	[illegible]
7 days after operation	98	8,000
12 days after operation	[illegible]	[illegible]

In Table V there seems to be some approach to a constant proportion between temperature and leucocytosis. In two of the cases included in this table a hæmorrhoidectomy was performed which, of course, resulted in more local infection and consequent higher counts, so that I think one could subtract about 2,000 from each day's average, which would show a more accurate result.

TABLE V.—AVERAGE TEMPERATURE AND WHITE BLOOD CELL COUNT IN SIX CASES OF MILD PROCIDENTIA WITH NO PREVIOUS INFECTION

Procidentia with relaxed perineum and cystocele—retroversion in 3 cases	Temperature	White cell count
1 day before operation	98	7,608
1 day after operation	98.4	14,775
3 days after operation	100	12,285
5 days after operation	100.2	10,125
7 days after operation	99	9,667
12 days after operation	98	8,983

TABLE VI.—AVERAGE TEMPERATURE AND WHITE CELL COUNT ON EXCISION OF THREE OVARIAN CYSTS—NO PREVIOUS INFECTION

Removal of cysts in two cases and removal of cyst and right tube in third case	Temperature	White cell count
1 day before operation	98	8,600
1 day after operation	98	11,683
3 days after operation	99.6	9,000
5 days after operation	99.2	7,833
7 days after operation	98	7,433
12 days after operation	98.2	7,300

From Table VI it would seem that the less that is done in the pelvis the nearer we come to a constant ratio between temperature and leucocytosis. The averages in this table show that there is very little rise in the white blood counts following abdominal incision, provided the authority who has stated that *normal* leucocytosis may reach 10,000 is right in his assertion.

TABLE VII.—TEMPERATURE AND WHITE BLOOD CELL COUNT IN TWO SINGLE CASES—NO PREVIOUS INFECTION

Lacerated perineum with anal fistula	Temperature	White cell count
1 day before operation	98.2	7,800
1 day after operation	98.2	11,000
3 days after operation	98.2	10,650
5 days after operation	98.4	10,000
7 days after operation	98.8	10,000
12 days after operation	98.8	8,000

erated perineum	ature	count
5 days after operation		
7 days after operation		
12 days after operation		

Although some rise of temperature would be expected in cases as shown in Table VII, we find none; on the other hand we do find a rather high leucocytosis, higher than we get in some laparotomies. While the cases shown are not average cases they do show the resultant leucocytosis when operation is done in any infected area.

TABLE VIII. AVERAGE WHITE BLOOD CELL COUNT—HISTORY OF PREVIOUS INFECTION IN THE PELVIS

tomies	count
3 days after operation	
7 days after operation	10,450
12 days after operation	
B.—Hysterectomy and salpingo-oophorectomy, repair of cystocele and rectocele	
Day before operation	
Day after operation	20,000
3 days after operation	
7 days after operation	10,000
C.—Vaginal hysterotomy and supravaginal hysterectomy	
Day after operation	14,000
5 days after operation	
D.—Hysterectomy and fibroid uterus. Mas	
Day before operation	
7 days after operat	

There was such a variation of temperature in the cases shown in Table VIII that it was useless to record it. The leucocytosis shown in item A is an average from ten cases, but the counts in these cases on the respective days varied so much that the resultant average, I think, is not a practical one for a working basis. The previous infection in the pelvis probably accounts for the varying counts, although as far as we know the infection had subsided at time of operation. There is the same wide variation shown in items B and D. The lowered leucocytosis shown in item C (hæmolytic streptococcus) in which as one author reports, we get a very small rise of white blood cells. The patient in this died on the fourth day after operation.

myomec-	
Dilatation	
Endome	
aphy	
7 day	

The averages shown in Table IX illustrate the difference between vaginal operations and vaginal plus abdominal operations.

ation	14,000
ratory laparotomy—Removal of section for	
Day before operation	6,600
7 days	7,400

The high leucocytosis in the first item in Table X, I think, is due to the probable confined infection in the vaginal cavity. These counts again demonstrate the normal white blood cell counts following simple abdominal incision.

TABLE XI.—WHITE COUNT AFTER DIATHERMY OF MALIGNANT TUMOR

	White cell count
Carcinoma of bladder; diathermy through cystoscope	
Day before operation	9,850
Day after operation	17,000
3 days after operation	16,800
5 days after operation	16,850
7 days after operation	16,150
12 days after operation	14,600

In Table XI, the leucocytosis is due evidently to a continuous cystitis which is stimulated by diathermy.

TABLE XII.—COMPARISON OF AVERAGE LEUCOCYTOSIS IN VARIOUS TYPES OF CASES OPERATED UPON WITH HISTORY OF NO PREVIOUS INFECTION

	White cell count
Hysterectomy (fibroid)	
Day before operation	6,707
Day after operation	14,470
3 days after operation	10,007
5 days after operation	8,614
7 days after operation	8,007
12 days after operation	8,714
Salpingectomy (ruptured ectopic)	
Day before operation	10,125
Day after operation	10,600
3 days after operation	9,075
5 days after operation	8,400
7 days after operation	10,300
12 days after operation	10,175
Suspension of uterus	
Day before operation	7,008
Day after operation	14,775
3 days after operation	12,283
5 days after operation	10,125
7 days after operation	9,667
12 days after operation	8,983
Ovariotomy	
Day before operation	8,600
Day after operation	11,683
3 days after operation	9,900
5 days after operation	7,833
7 days after operation	7,433
12 days after operation	7,300
Perineorrhaphy and colporrhaphy	
Day before operation	7,250
Day after operation	14,450
3 days after operation	16,700
5 days after operation	9,550
7 days after operation	7,750
12 days after operation	7,200

Table XII shows in the five common gynecological operations a decided difference in the postoperative leucocytosis. Each type of operation seems to have an average count peculiar to itself.

CONCLUSIONS

1. In gynecological cases with a history of no previous infection, the postoperative leucocytosis during certain intervals of convalescence, with a possibility of slight variation, is constant.

2. During the convalescence, following the five common types of gynecological operations above mentioned, one can be sure in most cases, with no gross complication of the leucocytosis at the stated intervals.

3. In gynecological cases in which there has been previous infection, the average leucocytosis cannot be depended upon, because of the wide variation of the count for each respective day. There is also uncertainty as to the type of previous infection and furthermore, the cases are operated on at different intervals after previous infection.

4. There is a very uncertain ratio between the temperature and the leucocytosis in all postoperative gynecological cases.

5. There is little increase in the white blood cells following simple abdominal incision.

Realizing the comparatively small number of cases observed in this series, there may be ample room for criticism, but with those averages derived from 2 to 14 cases of each type of operation, especially those with the history of no previous infection, we are reasonably certain of the results.

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AN ENDEAVOR TO EVALUATE CHRONIC SEPSIS IN PREGNANCY

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[illegible]

PART II

IN the first part of this paper I have submitted evidence that the placental infarct is due to infection of the maternal blood vessels of the placental site. This evidence demonstrates the presence of a clinical entity in pregnancy which has chronic sepsis as its continuous etiological factor. It remains to take up in detail the results which follow upon the infection of the placental site.

It should be borne in mind that most infarcts are the result of infection of a low-grade virulence. When these bacteria lodge in the maternal vessels of the placental site, a hæmorrhagic lesion results, followed by thrombosis. A similar lesion results in the fœtal placenta on the opposite side of the villous membrane which is secondary to the lesion in the maternal blood vessels. This thrombosis in the placenta results in a coagulation necrosis. Such a process is generally local, similar to the hæmatogenous boil. At times it is multiple but more frequently it is a repeated localized process which can be demonstrated by finding infarcts in various stages of development in the same placenta. The acute infarct is a red inflammatory condition which can not always be identified by the naked eye. The white infarct is the end-result of the red infarct (1).

The results of infection of the placental site will be taken up under three main headings. Effects of infarcts (A) on the placenta, (B) on the baby, and (C) on the mother.

A. The process of infarct formation destroys the function of just so much of the placental tissue as is involved by the thrombotic process. Thus a portion of the total area of feeding surface for the fœtus is taken away. In the early months of pregnancy when the total placental area is small, the infarcted area may be relatively large. When this proportion is large enough, it results in termination of the life of the fœtus which in turn results later in miscarriage, or the throwing off of the dead fœtus. The greater incidence in miscarriage within the first three months is thus explained.

The infarcted area in the early months of pregnancy may occur in the middle of the placenta or on its edge. When it is on the edge of the placenta, the damage done prevents the further enlargement of the placenta at that point. As has been pointed out, the distance from this point to the base of the cord gives an idea as to when the damage took place. When the concentric enlargement of the placenta is thus inhibited, there is compensatory growth on the undamaged edge of the placenta to supply the needs of the growing fœtus. This results in the asymmetrical type of placenta which varies from the typical battledore type when the damage is done within the first month of pregnancy to the type which is only slightly asymmetrical when the damage is done late in pregnancy.

PLACENTA PRÆVIA

It is well known that the point of attachment of the fertilized ovum to the uterine wall varies from the region of the fundus down to the cervix. This has been believed to be the etiologic basis for placenta prævia and will explain many cases. The following case will demonstrate such an event.

Case 10. A multipara in the [illegible] month of her pregnancy had a profuse hæmorrhage. Labor followed immediately and, within one-half hour after arrival in the hospital, she delivered herself of a small, well formed fœtus which made several attempts to breathe. The placenta was consistent in size with the term of the pregnancy and the circumference was [illegible] perfect [illegible] from the insertion of the cord to the center. The membranes were complete and showed the point of rupture exactly on the edge of the placenta. Here, therefore, was a normal placenta in the lower uterine segment which by its normal enlargement had become a marginal placenta prævia. No infarcts were visible on either surface of the placenta and the pregnancy had been without untoward symptoms up to the time of the hæmorrhage.

Port Lawrence, July [illegible]

In my paper entitled a "Clinical Study of the Placenta" (2), I reported a case to show that when the original attachment of the ovum is low enough in the uterus, an infarct in the early months of pregnancy may drive the compensating growth of the placenta downward with the result that low attached placentas, marginal and complete placenta prævias may result.

In such a case the placenta is generally of the battledore type with the cord attachment on or near the edge.

The following case reported by W. B. Thompson (3), with his accompanying illustration, is an example of this type. The illustration shows a complete placenta prævia *in situ*. The cord is attached to the edge.

In her history it is stated that she had had three spontaneous deliveries followed by a miscarriage. The patient had a temperature of 100.6° on admission. A macerated fœtus was found. The microscopic examination of the specimen contains the following: "At its (the decidua) junction with the chorionic membrane, there are numerous areas of closely packed polymorphonuclear leucocytes in various stages of preservation which apparently represent *minute miliary abscesses*." Sections through the posterior wall at the placental site show that the placenta is almost *entirely infarcted* and presents numerous areas of calcification. No trace of decidua is seen beneath it, for the reason that the tissue is so densely infiltrated with leucocytes as to obscure the details of the structure. The leucocytes extend far out into the muscularis forming parallel rows between its fibers."

The position of the cord in this case shows that concentric enlargement was inhibited by very early damage to the placental site. A complete placenta prævia is the result. The question of source of infection to cause this is clouded by the operative measures which followed the miscarriage. The miscarriage itself is an evidence of damage from chronic sepsis and antedates this operative procedure. That the placental site has been attacked by infection is very clear from the description in the microscopic examination. This evidence plus the presence of many infarcts is all consistent. The microscopic examination in this case should be compared with that of the case of Cornell and Earle previously reported (4). In this latter case the examination of a placenta *in situ*, the whole uterus having been removed shortly after a bleeding spell or threatened miscarriage at the second month, likewise shows evidence of many minute necrotic areas of infectious origin.

Here, therefore, is another feature in the cause of placenta prævia, and it should not be lost sight of that *a certain proportion of this class are preventable* by removing known foci of chronic sepsis before they do harm. What proportion of low attached placentas, marginal and complete placenta prævias can be attributed to infarct formation in the early months of pregnancy, can not be stated so soon, but from what experience I have already had with this point in view, it will be a surprisingly large proportion.

PLACENTA CIRCUMVALLATA

Case 11 demonstrates that infection of the whole edge of the placental site may be the determining factor in the so-called placenta circumvallata or its modifications.

B. The effects of infection of the placental site on the fœtus and baby may be considered under two headings:

1. The results of infarct formation on the fœtus;

2. The results of direct infection of the fœtal tissues.

1. When a section of placenta has been destroyed by infarct formation, the rest of the placenta must enlarge to compensate for the needs of the growing fœtus. Multiple infarcts therefore frequently result in the small or undernourished child so frequently seen in association with toxæmia of pregnancy, a disease which is almost consistently associated with infarct formation. The same process which reduces the nourishment of the fœtus may result in complete inadequacy of the placenta, thus bringing about the death of the fœtus *in utero*.

The association of macerated fœtus with the much infarcted placenta has long been recognized. Note Dr. Thompson's case above described. In a study of 201 stillborn children at Memorial Hospital during the last ten years, 50 of them (25 per cent) were macerated fœtus. Thirty-three of these, or 66 per cent, of the total were from mothers who showed evidence of toxæmia during their pregnancy.

Although no record was made in these cases of the condition of the placentas, it is safe to assume that all of the toxic cases had infarcted placentas and many of the non-toxic would have also shown infarction. I do not believe my experience has been unique in finding that there are numerous cases which show a much infarcted placenta without much toxæmia being present, and vice versa.

The placenta circumvallata and its modification represents nature's method for conquering the damage done by a ring of infarct formation along the circumference of the placenta. If this damage is not conquered, it is plain that by the failure of the placenta to enlarge the fœtus may be born prematurely, alive or dead, as the case may be. The relative maturity of the pregnancy at the time when the damage occurs has great influence on the results. The effects of placenta prævia in its different types upon both mother and baby are too well understood to go into them in detail.

Although many of these features have been recognized for years, they assume a new importance when it is recognized that the process by which they are brought about is frequently fundamentally due to a removable cause in the form of chronic sepsis.

2. Direct infection of the fœtus from the placental site.

a. Malformations. The potential power of the fertilized ovum for cell differentiation is wonderful to contemplate. That this process of differentiation is governed by definite laws is evident by the uniformity of the end-results. Certain variables, however, enter this field which are known to us as hereditary characteristics or units. The question has always been a mooted one whether deformities are a hereditary characteristic. The association of many deformities with acquired syphilis tends to show not only that the deformity is an acquired attribute but also that the infection may be the primary damaging factor.

Much the largest percentage of all deformities occur in the region of the head. Hydrocephalus, anencephalia, harelip, absence of ears or some part of the head are the more common forms of deformity. This preponderance of failure of development in the region of the head becomes significant when we consider it in relation to the fœtal circulation.

The most direct route for the fœtal blood as it comes from the placenta is through the liver and heart to the region of the head. It is a generally accepted theory that this fact explains why the baby's head is the largest and best developed portion of the body. The blood that reaches this portion of the body has the largest percentage of food products and oxygen for the development of the fœtus. By this same token any damaging element in the blood coming from the placenta would result in a higher percentage of incidence of damage in this same region.

With the knowledge that we now have that the placental site becomes infected, this preponderance of head deformities in association with the fœtal circulation becomes of great significance.

That bacteria do pass the villous membrane is established in numerous ways. The work of DeLee (5), Curtis (6), and the disease of syphilis establishes this beyond a reasonable doubt. It is, however, to be borne in mind that the above examples quoted are cases of virulent infection. Infarct formation is more characteristically associated with sepsis of a low grade of virulence. The damage which results from the passage of bacteria through the villous membrane is, therefore, dependent on two main factors: the virulence of the bacteria and the time in the pregnancy when such invasion of the fœtus occurs.

During the first forty days of embryonic life, the fœtus may be described as a series of bundles of cells which have the potential power of differentiation into the different parts of the body. Injury to one of these bundles of cells is capable at such a time of destroying the whole or a part of a bundle with the result that a failure of development will follow according to the part destroyed. There is no power of compensation associated in the process of differentiation. The end-result is an absolute lack of the part destroyed with an associated disturbance or distortion of contiguous parts. Most malformations such as anencephalia, harelip, and the total absence of any part can be thus explained. In fact

if malformations are studied from this point they may be classified according to the time when the damage occurred. Thus a spina bifida of the lumbar region would have been a relatively late damage as compared to an anencephalic. The most of the cells of the spine had differentiated and only one group was damaged to form the low spina bifida. The absence of a hand would likewise be a relatively late damage.

The case of a spina bifida in a fœtus having a menstrual age of 79 days, reported by S. T. W. Cull (7), shows that malformations arise at a very early age of the embryo.

After the fœtus has become differentiated into its component parts, damage to any region is compensated for by the germ cells of that part which have the duty of replacement of tissue in later life. Such damages do not appear as failures of development.

With this conception in mind I have made observations on the placentas of deformed babies to determine whether or not there was infarct formation or evidence of damage to the placenta at the base of the cord as evidence of early infection of the placental site. I have seen nine consecutive cases of deformed babies which have been associated with placentas which were consistent with this conception.

The three following cases are examples.

Case 17. A primipara, age 35, with the history of frequent attacks of tonsillitis and an influenzal attack in 1918, also subject to neuralgia in the right shoulder.

On January 3, 1921, she had what she thought was a period but more scanty than usual. No more bleeding occurred until the latter half of April when she flowed continuously for 2 weeks, let up for 1 day, and then flowed for 2 weeks more. In May, I was called in consultation. Uterine mole was considered, but it was recommended to wait until the time for the onset of motion was passed. One week later (May 16, 1921) motion began. On September 7, the membranes ruptured and on the 15th she was delivered of a 6 pound baby, by Dr. O'Connor, by version and forceps to after coming head. The right auricle was entirely absent. The placenta was a typical battledore specimen with the cord attached to the edge. There was old infarct formation along this near edge.

The position of the base of the cord near the infarcted edge of the placenta records a very early damage and represents the time when the infection of the placental site took place. (See previous papers.) The damage which resulted in the total absence of the right auricle must have happened within the first 40 days or thereabouts. The damage to the placenta and the damage to the embryo were, therefore, chronologically coincident, and we know that the damage to the placental site was infectious in origin. The patient had at the time of delivery no recollection of any acute infection associated with the early weeks of her pregnancy. Two large tonsils with a history of frequent tonsillitis show a possible source of chronic sepsis, as well as several carious teeth with pusy inflamed gums. This history of bleeding in April is further evidence that the placental site was damaged by infarct formation. There was no rise of blood pressure or urinary changes during her pregnancy.

Another case of this type is most illuminating.

Case 18. A primipara, age 32, had her last period on February 4, 1921. Motion was felt on July 1. She had very large tonsils. Four of her teeth were crowned, two molars were very carious, a retained root was visible in the gums, all associated with pyorrhœa. She had been subject to neuralgia of the face.

During her pregnancy she had been nauseated every morning for 6 months, but aside from heartburn she had had no other evidences of toxæmia. Blood pressure at entrance was 120–80.

On September 24, 1921, she was delivered of twins by Dr. O'Connor. One baby was living and weighed 5 pounds. The other was an anencephalic with a cervical spina bifida and macerated.

The placentas were separate and not contiguous. The placenta of the living twin seemed normal except for a few small infarcts. The placenta of the anencephalic was less than half the size of the other placenta and appeared as in Figure 1. *a*, Represents a V-shaped indentation in the circumference of the placenta the apex of which was almost contiguous with the base of the cord. *b*, Represents a large white infarcted area in the opposite side of the placenta.

The findings in this case are similar to those in the other. The damage which caused the V-shaped indentation in the placenta must have occurred very early in the pregnancy. The anencephalic monster represents the damage done to the embryo at a corresponding period in the pregnancy.

The patient was asked if she had had any colds during her pregnancy. Her answer was.

"Yes, I remember that I was suffering from a chronic cold when I first discovered that I was pregnant. The cold lasted 3 or 4 weeks and that was in March." In this case the clinical sequence of events is, therefore, complete.

This case is important from another aspect because it shows that one twin can receive fatal damage while the other twin does not. In the first section of this paper I referred to Dr. Williams' case where one twin was syphilitic and the other not. Case 13 suggested a reasonable explanation of this phenomenon and I believe that this Case 18 is even more conclusive evidence of the real significance of Dr. Williams' case.

Case 19. The following case not only demonstrates the above conception of the origin of deformed babies but also shows by the persistence of pathology in each successive pregnancy a picture of the clinical entity which has chronic sepsis as its etiological factor.

Patient had diphtheria and scarlet fever as a child. Scarlet fever was followed by right otitis media. Her teeth were in excellent condition. The tonsils were large. Myocardial weakness was evident in all her pregnancies. Her first pregnancy was toxic and the baby had jaundice and inanition fever. The second pregnancy was a miscarriage at 3 months. Her third pregnancy was more toxic than the first and the baby was jaundiced and had inanition fever. A few months before her fourth pregnancy she was in bed 53 days with inflammatory rheumatism.

May 28, 1921, was the date of her last menstrual period in her fourth pregnancy. During the last of June she had a very severe sore throat with recurrent sore throats during the next 2 months. Vomiting persisted throughout this pregnancy. On January 15, 1922, or at 7½ months she started in labor and examination showed a uterus enlarged to full-term size. Patient stated that her abdomen had enlarged very rapidly. A diagnosis of hydramnios was made with probable deformed baby and *probable infarct at the base of the cord*.

There was about two gallons of liquor, the baby was an anencephalic monster and the placenta showed an infarct at the base of the cord. Fig. 2.

Figure 2, *a*, represents a white infarct histologically described as old inflammatory tissue running deep into tissue of placenta. *b*, Represents area of damaged placental tissues with collapsed blood vessels on the surface.

This case shows an acute infection in the throat just previous to the first skipped menstrual period associated with an infarct at the base of the cord and a deformed baby.

Fig. 1. Fig. 2.

Her previous history, two toxic pregnancies, a miscarriage, inflammatory rheumatism, and a damaged heart, demonstrates a persistence of pathology which can all be explained on the principle of hematogenous infection from a point of chronic sepsis in her tonsils.

Besides these three cases two babies showed unilateral valgus, one had a deformed œsophagus, and three others were anencephalics.

In connection with the etiology of deformities, the work of Stockard, of Cornell (8), is most illuminating. He has produced twins, double monsters and deformities in fish by limiting the available oxygen supply of the eggs at a crucial time in their development. This work tends to show that direct infection of the embryonic tissues is not a necessary feature. The observations above set forth, showing evidence of damage to the placental site in the early weeks of pregnancy, are, however, consistent with Stockard's work. The damage to the placental site may reduce the available oxygen supply to the embryo coming from the maternal blood vessels. The damage to the fœtus would in such a case depend entirely on the time in the development of the embryo when such a reduction in the oxygen supply took place. Case 17 with the absence of one ear, the other being perfect, would suggest, however, that damage to the embryonic tissues was extremely local. Such evidence is more consistent with the conception that the damage is brought about by direct infection of the embryo.

b. Miscarriages. I have already endeavored to show the relation of infection of the placental site to miscarriage. It is common knowledge that many of the fœtus associated

with miscarriage are deformed or imperfect. It has been the experience of some to find an [illegible] but with a cord. All these manifestations are explained by the above conception of the processes involved. It is substantiated by the work of Curtis (10) who inoculated rabbits with the streptococcus obtained from stillborn children. Not only miscarriage resulted but absorption of the embryos also occurred.

The association of repeated miscarriages with syphilis is well established. Syphilis is a disease of long-standing, chronic infection. The evidence herewith submitted points to chronic infection. The similarity of end-results is, to my mind, most significant.

As I have pointed out, the manifestations in the fœtus of direct infection from the placental site varies according to the time of the pregnancy when the infection occurs. Case 15 in the first section of this paper represents an example of what may happen from an acute infarct at the time of labor with virulent bacteria as the primary cause.

c. Inanition fever. If these bacteria are of a low grade of virulence and are passed into the fœtus at the time of labor, all grades of results will follow according to the kind of bacteria involved and their virulence. There is a great variety of theories as to the cause of the so-called "inanition fever." It is quite characteristic of this fever to drop as soon as the maternal supply of milk comes in. Feeding with cows' milk and forcing fluids has in my own experience had no definite influence either on the incidence or on the course of the fever. In searching the records of Memorial Hospital for cases of hæmorrhagic disease of the newborn, it became apparent to me that babies which showed the "inanition fever" were very frequently associated with mothers who showed evidence of other pathology of an infectious nature. I can not give figures for this assertion but I am sure of the existence of this association. These observations are also supported by the work of Grulee and Bonar (9). The following from their article, I believe is significant. "It is not impossible that this condition (inanition fever) may be combined either with the nature of the birth or with fever in the mother. Abnormal labors are noted in fifteen of seventy four cases and in thirteen instances the mother had fever."

In connection with the fall of the temperature which so characteristically takes place at the time or soon after the mother's milk is available for food, it should be remembered that Ehrlich long ago showed that antitoxins in the blood of the mother pass over into the milk and assume a distinct importance in the young (13). Likewise Lewis and Wells, of Chicago (11), conclude that "the colostrum furnishes to the newborn mammal protective anti-bodies which probably add much to its capacity to resist infection in early life." Also that "it is definitely established that such passive immunity as very young animals exhibit does not come ordinarily, if at all, by transfer through the placenta, but by alimentary absorption from the colostrum." If we regard this inanition fever as of infectious origin, that infection having been obtained during labor or the last few days of intra-uterine life from the placental site and that it is the antitoxins developed by the mother and passed on to the baby by her colostrum that brings about the drop in temperature as soon as the milk comes in, we then have a reasonable explanation of the phenomena observed.

d. Hæmorrhagic disease of the newborn. In a previous paper I called attention (12) to the fact that a very high percentage of babies who showed hæmorrhagic disease of the newborn were children of mothers who had had evidence of toxæmia of pregnancy and associated chronic sepsis. I wish to repeat this statement. The frequency of infarction of the placenta in association with toxæmia of pregnancy explains this relationship when it is recognized that infarction represents infection of the placental site.

With knowledge that we have that infarct formation can go on without the association of toxæmia, it is also plain that hæmorrhagic disease may occur without the association of toxæmia.

The nature of the disease itself with the malaise, limpness, lack of interest in nursing, and most important of all the accompanying fever speaks loudly in favor of an infectious origin. Numerous cases in my experience have

had a pustular eruption as a sequel to the attack of bleeding, one case in particular developing a very serious furunculosis of which it died later.

In all probability the cause of this disease lies in a specific bacterium. The two following cases are suggestive.

Case 20. A primipara [illegible] August 27, 1919, came under observation December 4, at which time she stated that she had been suffering from much nausea and vomiting during the first 3 months. She was still troubled with spots before her eyes, blurred vision, and dizziness. On January 9, she reported having had three nose bleeds. On the 12th and for the next 3 days she was confined in bed on account of cough associated with rales in right lung, blood-streaked sputum, and prolonged and distant high-pitched breath sounds. No rise in temperature was associated. The lung condition cleared in a few days. Following this onset, however, were repeated nose bleeds, characterized by the expulsion of masses of bloody mucus without frank hæmorrhage. Headaches persisted. Until April 21, 1920, the blood pressure had been subnormal, 100–60. On this date it rose to 130–100 and albumin appeared in the urine. The patient was sent to the hospital, and on the second day after entrance her blood pressure was 180–120. Recommendations in regard to her teeth had never passed the X-ray [illegible]. One retained root showed an apical area and one gold crown, upper right, showed destruction of the alveolar process. These were removed on May 3, and following the removal of the gold crown tooth the wound oozed blood for nearly 24 hours. The day before extraction the blood pressure rose to 190-125. The extraction took place on May 1, and on the 6th the blood pressure was 130–90, rising to 140–110 on the 9th. From then until delivery it remained on a level around 145–100. She was delivered of a 4-pound baby on May 24. Labor began with ruptured membranes and was extremely slow. Mid-forceps terminated the labor. The baby developed hæmorrhagic disease which was successfully treated by subcutaneous injections of whole blood. The baby showed a fever of 101° before the hæmorrhage.

The following laboratory findings were recorded: April 25, urine culture showed staphylococcus albus. The baby had a sticky eye on June 1, the eighth day. Culture showed staphylococcus albus and aureus. Catheter specimen of urine showed a trace of albumin with occasional leucocyte. The mother's coagulation time after the tooth extraction was 9 minutes (Lee's method). Tonsillectomy had been performed in 1918 and throat consultant found no remaining tonsillar tissue.

Here is a case which shows evidence of a tendency to bleed in the nasal mucous membranes at first. On extraction of a septic gold crowned tooth [illegible] found. The septic gold crowned tooth was directly under the antrum. This explains the relation of the tooth to the nasal mucous membranes. The signs in the lungs were associated with a crop of pimples on her face representing evidence of blood-borne infection. Albumin in the urine and evidence of toxæmia followed this clinical event. The baby, when born, showed a like tendency to bleed. The placenta was small, had velamentous attachment of the cord [illegible]. Note also the drop in blood pressure following the removal of the septic tooth.

Similar events occur in other cases.

Case [illegible]. A [illegible] in her eighth month, had premature labor and a 5-pound baby which died of hæmorrhagic disease. Her blood pressure was 100 [illegible] and albuminuria per urine.

Her second pregnancy was under my care and except for mild toxic symptoms terminated normally with a 6-pound 5-ounce baby. The baby was jaundiced on the fourth day. No fever, however. Patient's teeth were X-rayed and except for some pyorrhœa on the lower front with some root absorption, they were otherwise negative. Although the tonsils were small, the patient had an adenoid expression, a nasal voice, and some anæmia.

About one week before delivery of her third baby, she had several attacks of bloody mucus from her nose. Delivery of 5½-pound breech baby was rapid and without trauma. Baby cried readily. On the second day jaundice began and became progressively deeper until death occurred on the eighth day, associated with fever, convulsions, nystagmus and other evidences of intracranial pressure.

Deep jaundice and hæmorrhagic disease are believed to [illegible] skin. In this case there was no frank bleeding in the baby. Intracranial symptoms were apparent however. This history of hæmorrhagic disease associated with toxæmia in the first pregnancy, jaundice in the second baby and deep jaundice with fever and intracranial symptoms in the third pregnancy associated with bloody mucus from the nose in the mother within 10 days of delivery, if regarded from the point of view of chronic sepsis presents a picture of a clinical entity.

It is not a common occurrence to find cases of hæmorrhagic disease associated with such a set of symptoms as is above set forth. It is a very common occurrence to find hæmorrhagic

disease in association with toxæmia of pregnancy, miscarriage, and other evidence of the activity of chronic sepsis in the previous history.

Intracranial hemorrhage. It has been stated by Hedren (13) that 9.28 per cent of 700 infant cadavers showed intracranial hæmorrhage. Delivery was normal in 50 of these cases reported. It is recognized today that intracranial hæmorrhage is often a manifestation of hæmorrhagic disease. In view of my assertion that hæmorrhagic disease is probably due to infection of the fœtus from the placental site, I wish to emphasize that the arrangement of the fœtal circulation previously described may be the determining factor in this high percentage of intracranial hæmorrhage in association with infant deaths and the incidence of intracranial hæmorrhage in those that survive. There is overwhelming evidence already available that intracranial hæmorrhage is not so dependent upon birth trauma as it was formerly believed to be.

It has been advanced that hæmorrhagic disease is in some way associated with asphyxia and that operative deliveries and breech deliveries predispose to hæmorrhagic disease. If we regard the baby as already suffering from infection and in a weakened condition, the operative or breech delivery may be the aggravating cause of the asphyxia.

f. Jaundice of the newborn. Jaundice of the newborn is probably the most common pathological manifestation in the new-born baby. It is frequently associated with fever and in its severest form results in death. The older books on obstetrics call attention to its association with infection of the umbilical stumps. Deluca (14) has recently emphasized the frequent association between jaundice and intracranial hæmorrhage and even goes so far as to say that jaundice is a symptom of intracranial hæmorrhage.

If jaundice of the newborn is regarded as a manifestation of infection of the liver of the fœtus resulting from infection of the placental site, these observations may be correlated and explained. The peculiarities of the fœtal circulation offer a reasonable explanation. The liver of the fœtus is the first organ in the course of the blood coming from the placenta. It is in the liver that the spirochætæ are most commonly and abundantly found in the syphilitic child. The association of jaundice and intracranial hæmorrhage is made apparent if they are both regarded as lesions of a hæmorrhagic type resulting from infection borne by the blood stream of the fœtus, said infection coming from the placental site where similar hæmorrhagic lesions of infectious origin are found. Luska (15) in a study of 102 cases has found that jaundice of the newborn begins with a hæmoglobinæmia and in a number of cases he found hæmolytic staphylococci in the blood, in the granuloma of the navel and in the fæces. In 11 cases a hæmolytic agent closely resembling staphylolysins were present in the serum, and the author concludes that icterus of the newborn is due to a bacteriotoxic hæmolysis which was in his cases caused by hæmolytic staphylococci.

C The constant association of placental infarcts with toxæmia of pregnancy and eclampsia has long been noted. Many believe today that these infarcts are the cause of toxæmia and eclampsia. Young, of Edinburgh, who has shown that the infarct is the result of a thrombotic process (16) in maternal vessels of the placental site has recently published an article (17) tending to show that toxæmia is due to the toxins of autolysis resulting from infarct formation.

There are four principal objections to such a theory. First, the degree of toxæmia has no relation to the total amount of infarction in the placenta. This reason, although not conclusive, is indicative. Second, the symptoms of toxæmia often persist after complete involution of the uterus (18). Third, postpartum eclampsia may occur as late as the eighth day post-partum (18). Fourth, toxæmia of pregnancy tends to recur in subsequent pregnancies (19).

The last three reasons point to a primary cause outside the individual pregnancy and persistent throughout the subsequent obstetrical history of the patient.

It has been shown that the placental infarct is primarily a hæmorrhagic lesion, the evolution of which is characterized by a

coagulation necrosis. It is suggested that this placental lesion is secondary to a hæmorrhagic lesion of infectious origin in the maternal blood vessels of the placental site. It is further suggested that there is a strong analogy between these multiple hæmorrhagic and necrotic areas in the decidua basalis and the lesions of similar nature which are found in the liver, the kidneys, and the brain of the dead eclamptic. Placental infarcts are not the cause of toxæmia of pregnancy except that they may form a new focus of infection. They stand, however, as recorded evidence of blood-borne infection past and present.

LaVake was the first to insist that eclampsia was associated with and dependent upon chronic sepsis (20).

My own article called attention to the constant association of chronic sepsis with toxæmia of pregnancy and eclampsia (12). Mosher (21) called attention to the "frequent" association of chronic sepsis and toxæmia of pregnancy.

The infarcted placenta is in itself evidence of the presence of chronic sepsis.

The infarcted placenta is especially associated with three disease entities: syphilis, chronic nephritis and toxæmia of pregnancy and eclampsia. The first disease, syphilis, is a well recognized, chronic, infectious disease entity. The second, chronic nephritis, is today recognized as due principally to chronic sepsis. The observations of LaVake, Mosher, and myself above referred to have shown that toxæmia of pregnancy and eclampsia are associated with the presence of chronic sepsis. The infectious origin of the infarct has been shown by the sequence of clinical events set forth in the first section of this paper and borne out by the microscopical examinations of an infarcted placenta *in situ*. The associated phenomena with toxæmia of pregnancy, such as, antepartum hæmorrhage, stillborn babies, macerated or deformed fœtus, ill nourished babies, and premature labors are all explained by the infectious origin of infarcts in the placenta. These are consequences dependent upon the single principle of septic emboli in the blood stream of the pregnant woman which arise from areas of chronic or acute sepsis.

There is still further evidence that the activity of chronic sepsis plays a part in toxæmia of pregnancy.

MacKenzie (22) has pointed out that the future advancement of medicine lies in a closer study of the early symptoms of disease and the processes involved in the production of those symptoms. As an example he takes up the disease of appendicitis. He points out that the inflammation of the tissues of the appendix causes localized pain in the region of McBurney's point in the abdominal wall and a spasm or increased tone in the right rectus muscle. He suggests in explanation of these phenomena that the nerves of the sympathetic system around the appendix become stimulated by the inflammatory process and that this stimulus is transmitted to the cord and is there transferred to the sensory and motor neurons associated, with the result that the sensory nerve records pain and the motor neuron increases the tone of the muscle in its control. This explanation of the cause and effect he supports by other examples in the region of the abdomen.

There is another region in the body where this same line of reasoning can be applied. I refer to localized pain (neuralgia) in the neck and face associated with increased tone or spasm in the muscles, generally spoken of as stiff neck, stiff shoulders or drawing sensation in the back of the neck. It is my contention that these symptoms, particularly if they are recurrent over a period of time, are generally indicative of infection somewhere in the nose, throat, or teeth and are just as significant of the infection, either of an acute or chronic nature, in this region as they are in the region of the appendix.

There is a mass of clinical evidence to support the truth of this view just as there is in appendicitis.

Acute infection of the nasopharyngeal tract gives generalized or frontal headache. Local sinus infection gives one-sided headaches. Localized neuralgias are often cured by the removal of septic teeth or tonsils. Occipital headaches with the associated stiffness of the muscles of the neck are frequently cured by removing septic teeth or tonsils.

Experience has shown that when there is localized pain over the appendix and muscular spasm, that the proper method of treatment is to remove the inflamed appendix. Why? Inflammation of the appendix *per se* never injured anyone, but the appendicitis kills by the spreading of the infection to the peritoneum with resulting overwhelming infection. Thus the operation of appendectomy is in essence a preventive measure.

One of the reasons that appendicitis untreated is so deadly is the spread of infection to regions where the resistance is relatively low. The inflamed appendix is, therefore, nothing more than a focus of infection in the region where the resistance to bacterial invasion is low.

A certain amount of immunity has probably been established in the nose and throat which tends to bring about chronic sepsis in this region and which prevents rapid acute extension to surrounding tissues except under certain circumstances.

It is well established that these foci of chronic sepsis may be the original point of entrance of the bacteria which are found causing trouble in remote parts of the body. Here again the likeness to the sequence of events in appendicitis is apparent. The infection on the tooth root or the tonsil does not kill until it is transferred to some portion of the body where the resistance is relatively low. The seriousness of the situation is therefore dependent on the matter of chance as to where the migrating bacteria may locate to form a new point of infection.

MacKenzie has also pointed out that it is necessary to evaluate the early symptoms of disease in order to initiate treatment before the disease has caused irreparable damage. It is apparent, therefore, that if a neuralgia or stiff neck can be interpreted as symptoms of active chronic sepsis, these same neuralgias may be the earliest symptoms of such blood-borne diseases as endocarditis, meningitis, pyelitis, and the like.

Neuralgias, neuritis, headaches (often one-sided or occipital) and muscle spasms in the neck are so well recognized as a part of the picture of toxæmia of pregnancy that they are always enumerated as such in the textbooks on obstetrics.

Here, therefore, is further clinical evidence of the association of active chronic sepsis, if we regard these symptoms as evidence of the presence of chronic sepsis.

In view of the evidence submitted, it seems justified to advance the suggestion that these localized symptoms in the region of the head may be those symptoms which lead us to the point of entrance of the bacteria into the system which are causing the disease of toxæmia of pregnancy. It is no more possible to say that because a pregnant woman has neuralgia that she will later have eclampsia than it is to prophesy that an infected wound will cause death. The potential possibility is there, however.

It is the object of this paper to show that just as the sore throat, the skin lesions, the arterial lesions and the neurological lesions in syphilis are parts of a large clinical entity of which the chancer is the initial lesion, so in pregnancy the toxic mother with the associated breast abscess, the miscarriage, the antepartum hæmorrhage, the deformed baby and the hæmorrhagic baby are parts of a large clinical entity with acute and chronic sepsis as the initial lesion. Everything that syphilis can do in pregnancy can be done by chronic sepsis of other types of bacteria. In both cases the different manifestations are dependent on the single principle of hæmatogenous spread of infection. The infectious origin of infarcts binds all these factors together and thereby shows why the macerated fœtus, the miscarriage or the hæmorrhagic baby is so frequently associated with toxæmia of pregnancy and yet may occur without evidence of toxæmia. It shows that the breast abscess and the miscarriage are essentially the same process in principle. It shows that a case which has eclampsia with her first baby, associated with pyelitis followed by four miscarriages and finally a sixth pregnancy, is carried to term but associated with marked toxæmia, is not to be considered as several pathological units but one single pathological unit. Many, many cases show this persistence of pathology throughout their obstetrical history. A case showing uterine hæmorrhage

following an acute throat infection may represent a complete entity, but where such a patient shows other manifestations of septic emboli in the blood stream, the etiological factor must be continuous, and thereby demonstrates that chronic infection acts the same as the single acute infection. The potential danger of areas of chronic sepsis is thereby demonstrated. It is, therefore, plain that too much emphasis can not be laid on the importance of the removal of areas of chronic sepsis in the pregnant woman or the woman who expects to become pregnant. What is or is not chronic sepsis is often difficult to determine from the local signs. Systemic symptoms are of the greatest importance in determining the presence of a focus. The teeth and the tonsils, in my experience, share the responsibility about equally and very often together.

Some hints as to the results of treatment along these lines have been given in this paper. The subject of treatment and results will be dealt with in another paper. It is sufficient to state here that my results have been sufficiently satisfactory to warrant the statement that the clinical relationship is again apparent in the results of treatment on the basis of chronic sepsis as the primary etiological factor in the types of obstetrical pathology above set forth.

Removal of chronic sepsis in the presence of a pregnancy has very definite limitations, however. There is a very common saying prevalent among the medical and dental professions and among the laity that dentistry should not be done during pregnancy. I believe this saying is well founded when it is limited to septic conditions in the teeth. Disturbance of chronic sepsis often results in active sepsis. Injury to the placental site in the early months of pregnancy is more likely to result in miscarriage than later. Likewise it is recognized that many cases of toxæmia are precipitated by acute infection. It is, therefore, not advisable to disturb chronic sepsis in the presence of toxæmia of pregnancy.

The best time for the removal of chronic sepsis is either before or between pregnancies. If, however, chronic sepsis is found in the pregnant woman, the safest time for its removal is between the fourth and the seventh month.

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BANDL'S RING AND DIFFICULT LABOR[1]

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CHOICE of the above subject for presentation before your society is prompted by a desire to direct attention to the rôle of the ring in pathological labor. Since the days when Bandl described the structure, considered it a physiological accompaniment of labor and gave it a name, the ring has occasioned no little discussion and some debate particularly as to its relation to abnormal labor.

All textbooks discuss its physiology, mention its presence and tendency to rise as indicating threatened rupture of the uterus in obstructed labor, and describe the postpartum hour-glass uterus, for the particular shape of which the ring in tonic contraction is responsible. The author of one of the standard works of reference goes farther and considers tonicity of the ring as a complication of the first and of the second stages of labor; and applies the descriptive term stricture uteri to a complication of labor that is "not rare." On the other hand, a distinguished authority maintains that isolated contraction does not occur, a contention that may be correct but that is far from convincing, since it is supplemented by no attempt at explanation of cases of tonic ring *and* obstructed labor on any other basis. That two such opposite views confront the student is evidence that the active interest in the ring and difficult labor, that can be counted upon in time to establish the actual relationship between them, has yet to be inspired.

Unquestionably, a firmly contracted ring does complicate labor, as a reasonably extensive literature and the experience of competent observers bear witness to; and so often is spontaneous advance completely blocked, either because of it or because of other elements of dystocia with which the ring is associated, and so frequently is even operative delivery rendered difficult or impossible because of its presence that Bandl's ring and difficult labor is an association that merits investigation.

What follows is offered as a contribution toward establishing what may be termed the pathology of Bandl's ring and is written with the firm conviction that persistence of the ring is a striking feature of three varieties of dystocia and, further, that each is a distinct clinical entity because in no two of them are clinical significance and syndrome the same.

Division of the parturient uterus into upper and lower segments offers striking illustration of adaptation of an organ to the work it is to do. The task is expulsion of the ovum; and the force making it possible is supplied almost entirely by the contracting muscle.

Though the entire structure of the uterus is muscular, it is apparent that all of it is not given over to contraction. If it were, child and placenta would be held within the uterus rather than expelled from it as labor advanced. Again, as the lower segment expands sufficiently to allow its contents to escape with relative ease, while the upper segment contracts with force enough to produce subsequent advance, it is just as evident that upper and lower portions behave differently in labor.

Passive character of the lower segment is evident in its progressive thinning out and upward advance over the presenting part as the cervix dilates. The active upper segment cannot be examined directly during labor for reasons that are apparent. However, such an opportunity is offered at a time when its activity may be expected to be at its height, namely right after placental expulsion, and when its sustained activity controls postpartum bleeding. At this time, bimanual examination reveals the presence of a widely dilated and more or less atonic cervix and lower segment and a thickened and globular upper segment, the firmness of which varies with incidence and disappearance of more or less regular contractions. Between the two segments, and marking their physiological

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division, is a prominent, rounded ridge of more or less firmly contracted muscle completely encircling the uterine cavity.

The structure is the ring in physiological action and its important clinical characteristics are as follows: it is located approximately one-fourth of the distance from external os to fundus at the level of reflection of the anterior uterine peritoneum over the bladder; in terms of the pelvis, it is on a level with or just below the pelvic inlet; and its firmness and *inside* diameter are such that passage of the separated placenta through it commonly is retarded and not infrequently delayed indefinitely unless the Credé maneuver is carried out. With the foregoing characteristics of the postpartum ring in mind, various manifestations of its abnormal activity during labor will be more readily understood.

Though best known as Bandl's ring, there are two other terms applied to the structure. Because it is conspicuous as the uterus contracts down upon the irregularities of the fœtal ovoid during labor and upon itself postpartum, it is known as the retraction ring. Again, it is called the contraction ring; and the term is applicable if for no other reason than because it is descriptive.

Disregarding adjectives, rings are of two kinds; they are the physiological and the pathological. The former are part of the phenomena of parturition. They are physiological in that they facilitate, or at least do not retard, the process of labor, and they are manifestation of activity that make the early puerperium safe. The latter are abnormalities of the physiological. They are pathological in that they interfere with or obstruct labor and, therefore, make its conduct difficult.

Physiological rings can be felt at the height of contractions and, even though membranes have ruptured and the uterus is in contact with the irregularities of the fœtal outline, they are never so prominent as to interfere with upward advance of the lower segment nor with downward progress of the child; and they disappear between contractions. During the third stage they do no more than determine the shape the placenta will assume as it leaves the uterus, inverting it or bending it over upon itself like a cylinder as center or edge of the placenta meets the ring resistance.

Pathological rings are of two kinds. First is a ring presenting persistent tone in the presence of general retraction; and in cases of dystocia with which such a ring is associated it shares with the general condition responsibility for lack of advance. It is a true retraction ring because it is met only in cases of retraction and because it yields to treatment appropriate to the latter condition.

Second is a ring in tonic contraction in the absence of retraction of the rest of the uterus. Here the ring is a primary cause of obstruction in that advance is impossible as long as it persists; and whether it is designated Bandl's ring in tonic contraction, or persistent retraction ring, or tonic contraction ring makes little difference as long as its clinical significance is grasped. However, the term contraction ring will be applied to the structure, and the clinical entity encountered when labor is rendered difficult because of its persistent isolated contraction will be known as contraction ring dystocia.

The three conditions in which the ring is found in persistent contraction are, first, tonic (or capped) uterus, second, labor obstructed by general uterine retraction, and third tonic, isolated contraction of the ring or contraction ring dystocia.

Tonic uterus is so familiar a complication of parturition that its etiology, or symptomatology, or even its dangers need not be enumerated. Present discussion is concerned with reason for the ring's appearance and with significance to be attached to the well-known fact that, as the condition persists, the ring assumes progressively higher levels until maximum thickness of the upper segment is attained, when the attenuated lower segment not uncommonly ruptures

In the condition described, appearance of the ring is the inevitable result of progressively intensified and eventually tetanic effort of the upper segment; and its location marks the abrupt change from the thickening and globular upper segment to the progressively thinning lower segment that is inactive and that corresponds in its shape to portions of

the child's body contained within it. Tonic uterus occurs in grave malpresentation and malposition and in the rare instances of marked disproportion where the obstacle to advance is pelvic. Here the ring forms as a result of maximum effort of the uterus at advance of the child through the *bony pelvis*. That the uterus is 'capped' is proof that the child is quite completely expelled from it. The ring forms as the result of tonicity of the upper uterus and, therefore, *it is not primarily obstructive*. For the latter reason it can be and is drawn upward as obstruction persists and uterine overaction continues; and the heights to which it rises are determined only by the thickness the upper segment attains and by the resistance to its progress upward that the prominences of the fœtal outline offer.

That even in tonic uterus there are factors that limit the extent to which the ring can rise may well be emphasized at this point, and appreciation of this fact will make it easier to understand why, in cases where the ring is a *primary cause* of obstruction, the structure cannot and does not rise.

Junction of the thickened upper and thinned-out lower segments is indicated by the presence of a furrow across the anterior surface of the uterus that marks the location of the ring. It can be seen and felt to rise as the ring assumes progressively higher levels.

The ring in tonic uterus is pathological in that it is occasioned by retraction *during* labor. However, the resistance it occasions may not improperly be considered prophylactic, in that it postpones rupture that is inevitable if tonicity goes far enough without being relieved. For the latter reason, it might be contended that the tonic ring in capped uterus is more physiological than pathological. However, the latter significance is attached to it because it is met in association with an abnormality of labor that is decidedly pathological, and because the rising ring of tonic uterus is generally considered a pathological entity.

In labor obstructed by general uterine retraction, the ring shares with the latter the essential responsibility for lack of advance. It, therefore, is a primary cause of obstruction and to it, under these conditions, the term retraction ring is applied.

For purposes of discussion, the term retraction is applied to a state in which the whole uterus, and particularly the lower segment, is applied to the irregularities of the child. Retraction is pathological in that its presence offers resistance to upward advance of the lower segment and, therefore, to progressive dilatation of the cervix, and to subsequent passage of the child through it.

The fundamental cause of retraction is abnormality of uterine action as a result of which contractile efforts are sustained and intermittency (or complete relaxation between contractions) disappears. Although most marked after escape of the liquor amnii decreases the size of the uterine cavity, retraction does occur while membranes are intact. Although retraction is invited as attempts at manual or hydrostatic dilatation of the cervix are made, and may actually be produced if cervix and lower segment present tone when persisting in them, pronounced retraction not infrequently is met where manipulations of no kind have been practiced and where its presence is discovered only after routine lower segment exploration in attempt to explain failure in progressive dilatation of the cervix.

In practically all cases where there is history neither of dry labor nor of attempts at dilatation, and where retraction obtains, the uterus is irritable, in that subjective pain is marked and contractions in one or more respects are atypical.

The commonest cause of retraction is premature rupture of membranes *plus* heightened contractile efforts that follow escape of the fluid and that are designed to overcome abnormality of presentation and position, or moderate disproportion, with which the accident is so commonly associated.

In general retraction, the ring stands out as a prominent ridge encircling the interior of the uterus. It is a complete ring because retraction is general; although, as might be expected, it is more conspicuous as deeper furrows and depressions of the child's body are in relation with it. A striking clinical

feature of the retraction ring is firmness, that is little more pronounced than that of the muscle just above and below it. Proof of the latter contention is the fact that anæsthesia, sufficiently deep, eliminates ring and general retraction at the same time. With location of the ring along the uterine wall fixed, it is apparent that its position in relation to the child will depend upon the pelvic level assumed by the presenting part at the time of the appearance of the ring. With the former at the inlet, position of the latter is in advance of the presenting part. The ring is located behind the presenting part when the latter has reached the pelvic outlet before general retraction appears. In either case its position is maintained; and complete dilatation of the cervix is impossible as long as retraction persists. Tonic retraction ring almost invariably is a complication of the first stage of labor.

The characteristic symptom of retraction ring dystocia is more or less continuous pain low down in front. When occurring during the first stage of labor, pain of this type is suggestive of failure in progressive dilatation; because the pain of satisfactory dilatation is felt not in front but low down in the back toward the end of the sacrum. When progressive dilatation ceases in the presence of pain of the kind described, the diagnosis of ring obstruction is highly probable.

Physical signs are even more striking. Irregularities of the fœtal outline can be seen and palpated; and the uterus is felt to maintain a varying amount of tone between contractions. The lower uterus, particularly, is tender. Usually the cervix is incompletely dilated and seems rigid. Its peculiar feel is due to a combination of œdema, caused by passive congestion that results from tight grasp of the lower segment, and muscular tone that the cervix shares with the rest of the uterus.

Doubtless many cervices, the failure in dilatation of which are ascribed to rigidity, are of this type. Practically every cervix dilates when physiological forces are permitted to work upon it. In retraction ring dystocia such forces are nullified and dilatation ceases. Here rigidity is apparent rather than real, because it disappears quickly under appropriate treatment.

Signs referable to the ring itself are elicited only on lower segment exploration, when the structure can be palpated internally and its size and firmness determined. External signs [illegible] No furrow on the anterior surface of the uterus can be seen or felt, because primary location of the structure is on a level with or just below the pelvic inlet, *and it does not rise.* The ring can rise only as the lower segment is drawn upward; such motion is possible only as resistance [illegible] overcome, it obviously disappears as a cause of dystocia. A rising ring is proof that obstruction to advance that may obtain is *not* primarily uterine in origin.

Clinical course in labor complicated by retraction ring dystocia varies with time of its occurrence, with presentation, with degree of associated general retraction, and with methods employed to meet the lack of advance occasioned.

When occurring in the mid-first stage, labor is obstructed and there arise the dangers of intra-uterine asphyxia from interference with circulation at the retracted placental site and of cervical and lower segment laceration if attempts at overcoming apparent rigidity of the cervix by vigorous manual dilatation are made.

It is when general retraction sets itself up after the cervix is well dilated that the course is most affected. When the presentation is breech, the soft, compressible buttocks are readily directed into and often through a cervix not yet fully dilated. If at this time membranes rupture and retraction appears, the breech descends into the elastic funnel represented by the retracted lower segment and the legs, meeting resistance of the fixed retraction ring, become extended. Just how much extended and how firmly grasped will depend upon prominence of the ring and strength of contractions driving the breech onward. This is [illegible] in which a breech becomes impacted. Certainly, extended legs is never a primary attitude: it is the result of *resistance and ad-* In a frank breech, otherwise uncom-

plicated, the bony pelvis offers resistance, while engagement and descent represent advance: in retraction ring dystocia, resistance is greatly increased, with the inevitable result that the movable feet and legs are retarded and then extended upon the buttocks as the latter descend.

Again, in presentation by the breech, general retraction may not appear until late in the second stage, when the larger shoulder diameters enter the lower segment and stimulate it to increased activity. Here it is the retraction ring that not uncommonly causes arms to extend and adds to the difficulties of delivery.

In well-engaged vertex presentations, the ring is found encircling the child's neck, as might be expected since the structure has its origin along the uterine wall at a corresponding level. When once set up, further dilatation and even advance of the broad shoulders through it are impossible, and labor comes to a standstill. Here there is some danger of intra-uterine asphyxia because of general retraction; but risks are greatly increased if the condition is mistaken for inertia and treatment by stimulation with pituitary extract carried out. Greater danger to the child is that of injury to its head from pressure and traction by forceps when the obstruction is undiscovered and when attempt is made to produce advance by sheer tractile force from below. The ring *can be* dilated by such a force; but only with markedly increased risk of maternal and fœtal injury. It is in unrecognized cases of this type, where no *actual* disproportion obtains, that the most difficult manual dilatations and forceps operations are done.

With the vertex high, position of the retraction ring is in advance of the presenting part and here it remains, interfering with dilatation and descent. If membranes have ruptured, the ring is readily felt on routine vaginal examination; but when still intact, the bag of waters protrudes through the ring and reaches to the rim of the dilated cervix. In cases of the latter type, artificial rupture of membranes, that the well-dilated cervix and lack of advance invite, can be counted upon to add to the difficulties of labor already present. An ever present danger is prolapse of cord as membranes rupture and fluid gushes through the high ring.

For reasons that are apparent, in none of the groups cited does the ring rise; and, while it is firmly enough contracted to obstruct labor, transition from general retraction to tonic uterus is impossible.

The obstruction occasioned by tonic retraction ring could be prevented were *beginning* general retraction recognized, accorded curative treatment, and its causes eliminated. Therefore, if retraction has followed introduction of a hydrostatic dilator or bougies, their immediate removal is indicated; while, if it is occasioned by attempts at manual dilatation of the cervix, such efforts must be discontinued. When malpresentation or malposition, or moderate disproportion, or cervical and lower segment irritation occasioned by dry labor obtains, it is apparent that causes cannot be removed. Here retraction should be anticipated; and increased subjective pain and maintainance of a varying degree of tone between contractions treated by conventional doses of hypnotics or narcotics, or, if necessary, by discontinuous administration of ether. Such precautions are especially indicated if the patient is neurotic or the uterus irritable; because the condition not infrequently is encountered where none other than the two etiological factors mentioned obtain.

There is no more direct way to invite or actually to occasion pronounced retraction than to persist in attempts at manual dilatation of a rigid cervix. If the internal os is unobliterated, rigidity is physiological, and varying degrees of retraction almost invariably follow such relatively rapid attempts at dilatation; while, if entirely obliterated, rigidity is evidence of already-present retraction that can be counted upon to be markedly increased. With the internal os obliterated, the external os well dilated, and with the ring in advance of the presenting part, artificial rupture of membranes almost invariably intensifies retraction already present.

Retraction well set up, though as yet not absolutely obstructive, doubtless could be relieved by *deep* narcosis. However, the de-

pressant action of morphine on the fœtal heart is such that dosage sufficiently large to bring about removal of the ring is undesirable, if not dangerous. As satisfactory results attend deep anæsthesia secured by the continuous administration of surgical ether. When complete muscular relaxation is secured, the ring disappears; and untoward effects are absent.

Whether or not progressive advance is to follow return of contractile efforts as effect of the anæsthetic is recovered from is soon apparent. If physiological labor is resumed, the uterus is felt to relax completely between contractions, at which time fœtal movements can be felt and often seen. If, in the first stage of labor, return of mucosanguineous discharge gives evidence of progressive dilatation of the cervix; while, if in the second, contractions become actually propulsive and extragenital palpation (elicited by upward, digital pressure at one side of the vulva and beneath a pubic ramus) detects progressive advance of the presenting part.

If advance does not occur within an hour, it is probable that general retraction has again set itself up (since its causes may persist), and interference is indicated. The advantages of delay up to this point are twofold; the child is a better operative risk because the uteroplacental circulation has been given ample opportunity to re-establish itself and because the fœtal heart has been stimulated by the ether administered; while the mother has been given every chance to terminate labor spontaneously.

Active treatment of labor obstructed by tonic retraction ring must be undertaken with an appreciation, first, that the actual causes of retraction commonly persist and, second, that return of uterine activity too frequently re-establishes retraction. With the foregoing principles in mind, one secures *complete* uterine muscle relaxation that is possible with no less than 20 minutes of deep anæsthesia, and proceeds with treatment appropriate to the stage of labor in which the complication has arisen.

In ring dystocia, the writer has had experience with the use of but one anæsthetic —ether. Its results are so satisfactory in every way that he has hesitated to assume the responsibilities of the deep and prolonged *chloroform* anæsthesia that it is believed cases of the type would demand.

If the internal os is unobliterated, careful manual dilatation is done and the largest hydrostatic dilator that can reasonably be used is inserted. Instances of the kind are rare and treatment of them is not wholly satisfactory. Further, they require symptomatic treatment of all manifestations of returning retraction. With the internal os wholly obliterated, manual dilatation of cervix and lower segment, so complete that the closed fist can be drawn through without resistance being met, is done. Except that all contractile efforts have ceased, the patient now is in the second stage of labor and immediate delivery is desirable. Here, the theoretical objection to delivery in the absence of contractions is more than counterbalanced by quite complete immunity from *returning retraction* that a wholly inert uterus gives promise of.

From this point, procedure varies with presentation and, particularly in vertex presentations, with position of the presenting part in the pelvic cavity.

In breech presentation, where varying degrees of impaction and extended legs accompany retraction, the buttocks are pushed upward. This simplifies the bringing down of one and then the other leg. When any appreciable force is required to accomplish either of the foregoing, the ring and general retraction have not yet been eliminated and deeper ether anæsthesia is indicated. With the feet through the vulva, extraction is begun; it is accomplished with little difficulty if the uterus is kept relaxed and the loss of propulsive efforts compensated for by continuous, firm, fundal pressure exerted by the palms of an assistant's hands. When the breech is made to advance by *push* from above rather than by pull from below, the head is kept flexed and the arms remain folded across the chest. It is traction from below plus resistance of an incompletely relaxed lower segment that commonly extends the arms and that is responsible for much of the fœtal mortality in extraction by the breech.

Delivery of impacted, and uncorrected, breech presentation by traction at the groin is always difficult and entails an unnecessarily high fœtal morbidity from fracture and nerve traumatism. Even with impaction reduced and the legs down, extraction begun in the presence of a trace of general retraction, or persisted in after resistance to advance is encountered, becomes more and more difficult as the shoulders are reached, unless all contractile efforts are eliminated in the manner described.

In vertex presentations, the ease and safety with which delivery can be accomplished is determined in great measure by height of the presenting part. If at the outlet or in the mid-pelvis, cephalic application of forceps is made and sustained, though intermittent, traction is exerted, individual efforts being supplemented by diffuse downward pressure at the fundus.

With the presenting part in the high-mid pelvis, advance on occasion can be accomplished and labor terminated by conservative traction on forceps. With the head just engaged, and even when at a lower level, markedly increased tractile force is required to produce advance, for the reason that both presenting part and lower segment are drawn into the inlet at the same time. If efforts at advance now are persisted in, the child's head is subjected to undesirable pressure, the broad ligaments to overstretching, and the lower segment, cervix, and vaginal walls to the dangers of traumatism. Rather than persist in attempts at difficult delivery by high medium or high forceps operation under these conditions, it is urged that careful internal podalic version and breech extraction be done at once. It is a matter of personal experience with cases where the vertex is arrested high up that fœtal mortality and maternal morbidity are lowered as version and extraction are done following a single, unsuccessful attempt at producing advance by means of forceps.

Following delivery, persistent, gentle massage of the fundus can be counted upon to cause return of contractile efforts that, for purposes of placental separation and expulsion, are physiological; while termination of the third stage is followed by maintenance of satisfactory postpartum tone and complete immunity from undue bleeding. In other words, the uterus postpartum resumes its condition of retraction at a time when such a state is highly physiological.

However, the state of artificial inertia may persist; and, to meet its untoward manifestation, material for intra-uterine tamponade should be immediately available.

In contraction ring dystocia, the most striking feature is tonicity that is isolated in that it is limited to the ring, the upper uterus manifesting physiological contraction and relaxation. It differs in this important respect from retraction ring dystocia, where the ring shares with general retraction the responsibility for lack of advance and where the upper segment manifests sustained activity or tone.

Another and even more important clinical difference has to do with character of the ring itself. In contraction ring dystocia its tonicity is increased; it presents a firmness that may be described as board-like, and it resists efforts at relaxation far longer than does the ring in retraction. Further, its sharp (inside) edge contrasts markedly with the blunt or even rounded margin of the retraction ring.

Physical characteristics of the ring, combined with the fact that it is met associated with an upper segment that is not retracted, make possible a syndrome and a clinical course that are so peculiar to contraction ring dystocia that the latter and retraction ring dystocia may well be considered separate clinical entities.

Such a view is tenable even though the two complicate the same case. It is consistent even though in each the same pathological structure is the essential element of obstruction, the same etiological factors obtain, and the same general treatment is indicated. The respects in which the two resemble one another do no more than establish closeness of their relationship.

The actual cause of contraction ring dystocia is stimulation of circular muscle fibers, at junction of upper and lower segments, to tonic contraction; and its occurrence

in the individual case suggests either faulty innervation or irregular stimulation of an orderly nerve supply. Since the condition did not recur in a second pregnancy in one case and was met for the first time in a second pregnancy in another, it is reasonable to conclude that, in the cases cited, at least, quite normally innervated muscle behaved abnormally. Though excitation to abnormal muscular activity could arise from irregularities of presentation and position, from disproportion, from premature rupture of membranes, and from the irritating effects of oxytocics, hydrostatic dilators, bougies and the like, the fact that the condition has been met where none of the factors mentioned has obtained, where labor was both premature and spontaneous, and where membranes were intact, makes reasonable the assumption that the conditions mentioned are predisposing rather than actual or exciting causes. As might be expected, the condition is far more often met in the neurotic and highly organized individual than in her opposite. Altogether too often the etiology is obscure.

With physical characteristics of a well-established contraction ring in mind, its essential symptom and physical signs, as well as its influence on the clinical course of labor, will be better understood. Arising from a broad base that encroaches upon upper and lower segments, it tapers toward the long axis of the uterus so rapidly that its upper and lower surfaces are slightly concave and its inner edge thin. Since its outside is fairly constant, being limited by the walls of the uterus, it is apparent that the amount of obstruction a ring causes is determined by its inside diameter, and that the smaller the ring the greater will be the dystocia it occasions. Its position in relation to passenger and pelvis is the same as that of the retraction ring.

Complete obstruction is the immediate effect of appearance of tonic contraction ring. In that progressive dilatation ceases when the complication arises during the first stage and both spontaneous and artificial advance are rendered impossible with its appearance in the second, the obstruction occasioned is identical with that the retraction ring is responsible for.

An occasional third-stage complication of labor is incarcerated placenta with hæmorrhage. More familiar as hour-glass uterus, its treatment on occasion has been unsatisfactory, and it is known no less often to have entailed serious consequences. The term is applied to a placenta that is both *separated and retained;* and, therefore, does not include the structure that is retained beyond the conventional 20 or 30 minutes either because contractions have not re-appeared with strength and frequency enough to cause its separation or because the physiological ring is sufficiently prominent to retard its expulsion. Explanation of the state in which the placenta is found and that of the foremost symptom, namely persistent bleeding, are offered by presence of a tonic contraction ring. Separated by a physiological contractile effort of the upper segment, the placenta lies free within the cavity of the latter, the tonic ring making its expulsion impossible, and from the *unretracted* placental site, blood flows until momentarily checked by the infrequently-recurring third-stage contractions. Characteristic of contraction ring dystocia is presence of a tonic ring and of an upper segment that contracts and relaxes. The two are met in and explain all features of incarcerated placenta.

The characteristic symptom is atypical pain. In presence of abnormality the ring occasions, it is reasonable to expect contractions to be as atypical as they are ineffectual. Pain characteristic of the dilating cervix disappears. It is felt at irregular intervals and with varying intensity: not infrequently it becomes markedly propulsive as soon as obstruction is complete. All symptoms vary with position of the ring: when behind the presenting part, pain is increased because of continuous pressure to which the interior of the pelvic cavity is subjected; while, in ring-in-front cases, the presenting part is raised and contractions are characteristically less severe than in normal labor. A symptom that is no less common than it is striking is a degree of pelvic hyperæsthesia that makes simple vaginal exploration possible only as an anæsthetic is employed.

Considered in the order in which they are elicited, physical signs are referable to cervix, membranes, presenting part, and the ring itself.

Since contraction ring dystocia almost invariably is a complication of the late first stage, the cervix is found dilatable, and subsequent examination shows it to have failed in progressive dilatation in the presence of active, though atypical, contractions. Complete obliteration of the internal os indicates late first stage and shows the cervix to be dilatable. On the other hand, extent to which the external os is dilated is important only as it fixes the time when obstruction became complete and dilatation ceased; while its feel depends upon condition of the membranes. External os and lower segment seem firm only when membranes under tension distend them.

In the majority of cases seen early, membranes are intact. With tonicity limited to the ring, tension within the sac will not be increased and spontaneous rupture of membranes will be deferred if the fluid has additional space into which it can be directed. Compensatory dilatation of the inactive lower segment makes such displacement possible. Two other factors contribute toward maintenance of membranes intact: first, tight grasp of the ring behind the presenting part lessens pressure in the anterior amniotic chamber in much the same way the presenting part exerts its ball-valve action in normal labor; and, second, marked decrease in contractile efforts characteristic of location of the ring in advance of the presenting part tends to preserve the membranes intact. In the latter type of case it is not unusual to find the sac intact and protruding through an external os quite completely dilated. Were the membranes to rupture coincident with or after appearance of tonic contraction ring, varying degrees of retraction result.

However, it is not reasonable to expect them to remain intact indefinitely. Sooner or later they rupture, when consequent general retraction should be considered an added complication rather than a characteristic manifestation of the condition. Premature rupture of membranes is met in contraction ring dystocia, but with insufficient frequency to be considered one of its important causes.

A striking feature of signs referable to the presenting part is the fact that the ring is never found in contact with its broadest diameter. The presenting part advances against or recedes from the external os as the developing ring meets the head behind or in front of its biparietal diameter, just how far and how soon depending upon size and strength of the ring. In the same way, though to a less extent, grasp of the ring near the intertrochanteric diameter influences ultimate position of the buttocks in presentation by the breech.

Recession of the presenting part from contact with rim of the external os is an important diagnostic sign. Other conditions, particularly retraction and moderate disproportion, result in increasingly close approximation between head and external os; but recession is met in but one other condition, namely rupture of uterus. However, clinical picture of the latter is such that the two would never be confused. Recession has further significance. If carried far enough by increasing tonicity of the ring, it is possible for the presenting part, particularly in vertex presentation, to be lifted out of the pelvis and, maintained by the same force at the high level, for a secondary, transverse presentation to result. In two instances the condition mentioned has been met. In each case the malpresentation was known to be secondary; it could be accounted for by nothing done to or by the patient, who was under hospital care; and it was found to be associated with tonic contraction ring. The occurrence, then, of secondary malpresentation not otherwise accounted for may be considered presumptive evidence of contraction ring dystocia. No other condition explains as perfectly what has happened. Tonic contraction ring disengages the presenting part and the relaxed upper segment makes subsequent spontaneous version possible. No such sudden change in the clinical aspect of labor is possible in tonic retraction ring, associated as it is with upper segment retraction. This of itself is enough to establish the latter as an entirely different clinical condition.

In recession of the kind described, ultimate location of the ring will be found in advance of the presenting part. Indeed, with a ring located 7 or 8 centimeters beyond the external os and with the entire lower segment empty, it is logical to conclude that the presenting part has been made to recede, that formation of the ring is the cause of recession, and, finally, that location in advance of the presenting part is a secondary rather than a primary position. When the ring forms in front of the bisacromial diameter of the child, the presenting part recedes, but only for the short distance necessary to bring the neck on a level with the ring. The latter then sets itself up between head and shoulders, and further recession is impossible.

Signs referable to the ring are characteristic. Increased muscular firmness is met as the examining hand advances, is directed by the board-like, concave, inferior surface of the ring toward the uterine mid-line, and finally reaches the sharp edge of the ring in intimate contact with the child's body. In eliciting them it must be remembered that the tonic zone of muscle may not completely encircle the interior of the uterine cavity but may be prominent as a crescentic ledge to the right or to the left or, rarely, on the anterior or posterior wall. Further, a transverse furrow practically never is noted externally for the reason that the anatomical location of the ring is on a level with or just below that of the pelvic inlet. The rare instances where a shallow, transverse depression is noted in the lower uterus are cases in which the ring either is complete or forms along the anterior wall in the first place, and in which its location invariably is above the inlet in the second. Even if noted, its position remains permanent; for the tonic contraction ring does not rise.

Finally, when the ring forms behind the presenting part, the structure can be palpated directly only as the fingers and even palm of the hand are carried up alongside of the presenting part far enough for junction of upper and lower segments to be reached. This procedure may be possible only as an anæsthetic is employed to relieve pain and to relax muscular spasm of the soft parts.

Appearance of a new presentation and transition to retraction of the upper segment have been mentioned as manifestations of the clinical course of unrecognized and untreated contraction ring dystocia; but secondary malpresentation is not usual nor is rupture of membranes characteristic. Further, doubtless few cases are diagnosed, and the question at once suggested is: Why, if the condition is a major complication of labor, is its discovery so rarely made? To it there are two answers. First, in the presence of no apparent cause of so complete obstruction, attempts at operative advance are persisted in until delivery is accomplished, probable damage to mother and child being charged to the extreme difficulties encountered. In none other than an unrecognized case of tonic contraction ring is it conceivable that dangerous and obsolete embryotomy would be done. Second, if the obstruction occasioned by tonic contraction ring is not diagnosed, if membranes remain intact, and, further, if no attempts at forcible delivery are made, spasm of the muscle may be expected in time to pass off, when, with removal of obstruction and return of contractile efforts, labor may terminate spontaneously. The occasional case where active labor has ceased and an interval of several days has elapsed before returning contractile efforts result in spontaneous delivery may possibly be explained on this basis.

Contraction ring dystocia is to be suspected in cases of second stage delay where all other causes of obstruction have been eliminated, or where those that persist cannot explain the difficulty, and search for a tonic ring made at once. So closely may the lack of advance simulate that due to inertia and, again, to retraction that differential diagnosis often is possible only as region of the ring is explored arbitrarily for evidence of tonicity. Little difficulty is offered where inertia is actual, for there is a history of physiological contractions progressively decreasing in frequency and in intensity and signs referable to the ring are negative; while, with inertia relative, moderate disproportion between passenger and pelvis is apparent. The contractions in retraction ring dystocia are not unlike those

met in tonic contraction ring. However, [illegible] in the upper segment and the fact that the membranes have ruptured make the diagnosis of general retraction presumptive.

When primary malpresentation and pelvic contraction are complicated by tonic contraction ring, diagnosis of the latter may be missed because the former are thought adequately to explain the delay. In cases of the kind, knowledge that the ring is not in tonic contraction is of inestimable value. Were its tonicity to complicate the situation, the ring becomes the primary cause of obstruction because, until it has been made to disappear, it is impossible to carry out operative treatment the associated abnormality demands.

Granted a tonic contraction ring has escaped detection and conservative attempt at traction on head or breech has been made without producing advance, the possibility of uterine obstruction must be considered and region of the ring palpated for evidence of tonicity.

Treatment of contraction ring dystocia is simple and satisfactory provided two demands are met. They are, first, immediate removal of the tonic ring as the obstacle to advance and, second, maintenance of a state of complete uterine muscle relaxation. Importance of the latter is due to the fact that the uterus is irritable and tonicity, though momentarily removed, is quickly resumed if the uterus is capable of response to stimulation, some measure of which is invariably occasioned even by the most careful operative delivery. The only impassable ring the writer has met was one that reappeared following a conservative dose of pituitary extract given with the expectation of facilitating breech extraction. Needless to say, employment of oxytocics in all varieties of uterine overaction is absolutely contra-indicated.

Under sufficiently deep and prolonged ether anæsthesia, the ring eventually fades out, irrespective of length of time the obstruction has persisted. Never should attempt at manual dilatation of the ring be made; it does nothing more than accentuate tonicity and, further, it is unnecessary. When the lower segment including the ring is thinned out and relaxed, treatment appropriate to stage of labor, to presentation and position, and even to such an accident as prolapsed cord may be begun. Because of the danger of returning tonicity, it is desirable if possible to proceed with immediate delivery. However, at even a suggestion of returning tonicity, all manipulation must be discontinued until deeper anæsthesia makes it possible to proceed without meeting muscular resistance. Subsequent operative treatment is governed by the same general principles that have been considered in connection with retraction ring dystocia.

Abdominal cæsarean section has been performed where the contraction ring has been found to be impassable. Did such a ring lie behind the presenting part, encircling the child's neck for instance, the fact that delivery through the usual high uterine incision was possible is proof that resistance the ring offered eventually was overcome. Success here may reasonably be attributed to the deep anæsthesia under which the operation was done. If during section the ring became passable, the original contention that the ring could not be passed may not be maintained. With an impassable ring in front of the presenting part the writer has had no experience; all have been found to yield to complete, surgical anæsthesia. The only indication for section in contraction ring dystocia would seem to be association of one or more of the conditions that demand the operation.

With treatment based upon the principles described, the fœtal and maternal mortality and morbidity of contraction ring dystocia itself are negligible.

The foregoing is written with the firm conviction that tonic contraction of Bandl's ring is not an uncommon cause of dystocia, and that there is no unfailing symptom other than obstruction and no invariable physical signs other than those referable to the ring itself. It is presented with the hope of inspiring increased interest in a complication of labor that entails high fœtal mortality and morbidity when its presence is unrecognized and the obstruction offered by it is met by sheer tractile force.

EFFICIENCY IN THE DIAGNOSIS OF NEOPLASMS

BY WILLIAM C. MacCARTY, M.D., F.A.C.S., [illegible]

QUESTIONS have often been asked for the purpose of formulating a plan by which they may be answered and the one which I am about to ask and shall attempt to answer is: "Have we, as a profession, reached our greatest efficiency in the clinical diagnosis of neoplasms?" We have spent a great amount of time and some money trying to educate the public on the frequency of cancer and other detrimental conditions, but have we sufficiently taken stock of our efficiency in recognizing the condition after the public has come to us? With the aid of surgery, roentgen-rays, and radium we have some idea of what we can do in treatment, although these agents are still in an experimental stage. There is one generalization which may be safely and fairly made, and that is: the earlier the stage of the neoplastic growth, the more readily it responds to treatment, which means that we must attempt to improve our diagnostic methods so that we shall be able to recognize all malignant and potentially malignant conditions early.

I have no means of determining your diagnostic efficiency, but I have had the opportunity of studying the efficiency of a group of well-trained, comparatively young men, all graduates of Class A medical schools in this or other countries, and I dare say that their diagnostic ability is equal to, at least, that of the general medical practitioner. I have taken, as part of my material, the results of a comparative study of the preoperative instructions or diagnoses, and the actual pathological conditions found at operation, checked by a surgical pathologist. In order to make my point clear I shall confine my remarks to one organ, that is, the mammary gland, which is very superficial, easily palpable, easily visible, and one of the most common sites of benign and malignant neoplastic conditions. The tabulation presents certain facts, in terms of percentages, which are somewhat startling to those of us who have prided ourselves, blindly, on our diagnostic ability. By way of soothing our offended pride, I might say that these data are a credit to our profession, if we are willing to admit that there are physical limitations to the diagnostic capability of our five senses. Our chagrin might be lessened, also, by the fact that when clinicians make a positive diagnosis of a malignant condition they are correct in 94.5 per cent of the cases; and this is the percentage we like to quote; it is, however, not the index of our diagnostic efficiency, so far as the patient is concerned.

TYPES OF DIAGNOSES

The 21.5 per cent of doubtful diagnoses means that, after all known methods of diagnosis have been tried, there still remains 21.5 per cent of the breasts in which an honest clinician is not willing to attempt to fool himself. He is willing, however, to admit this percentage and express himself in one of four ways: by making a diagnosis followed by a question mark; by using indefinite terms such as nodule, growth, or mass, by writing "no diagnosis", or by

Presented [illegible]

suggesting that the specimen be removed for diagnosis. He expresses a suspicion of malignancy in 50 per cent of all his doubtful diagnoses, which leaves the making of the diagnosis to some one else. The fact that 21.5 per cent of his diagnoses are doubtful and that he expresses a suspicion in his doubtful diagnoses suggests that he must expect a diagnosis to be made either by the surgeon, who operates, or by an associated surgical pathologist, or some general pathologist. Now suppose you are the surgeon and have no surgical pathologist, what are you going to do with the 21.5 per cent and the 50 per cent? This is the question which every surgeon faces. When also facing the fact that only 51 per cent of the breast tumors are malignant and that 94.5 per cent of your malignant diagnoses are correct, what is your scientific criterion for operative procedure? Maybe you will say that in a doubtful case, at or above middle age, it is best to do the radical operation; it is better, you might think, to sacrifice a few benign breasts for the sake of radically treating those with cancer. This is a very old way of reasoning and is one which, undoubtedly, is justifiable if there were no way to avoid it; but there is a way whether you have it or not. You are not to be condemned if you haven't it, but you are to be condemned if you do not attempt to have it. The patients with the doubtful diagnoses and the 5.5 per cent of mistakes can be efficiently taken care of. I have seen more than one surgeon who sought this aid for members of his own family when he did not seek it for his patients. In the whole series of 2100 breasts which were studied, not one was unnecessarily treated too radically and not one failed to receive a radical operation when necessary, and this came about by virtue of the fact that all cases were checked, at operation, by a surgical pathologist.

Now there are certain reasons why all breast cases are not checked: (1) you may not have a pathologist; (2) you may not have tried to have a pathologist; (3) there may not be a pathologist near you; (4) you may think you are a great pathologist especially a great gross pathologist in which case you simply incise the tumor, immediately after its removal, and pass judgment; (5) you may not believe in frozen sections; (6) your practice may not be large enough to allow you to pay a pathologist; (7) you may be depending upon the hospital to supply you with a pathologist; (8) you may have lost faith in pathologists because you have had sad experiences with men who call themselves pathologists, or with the so-called interne pathologist who happens to be sojourning in the hospital for a year or two doing everything in the categories of tissue pathology, bacteriology, serology, clinical microscopy, and sometimes roentgenology.

These are all reasons, but they are not all good reasons why your patient should not receive the same diagnostic efficiency you are apt to give your wife, daughter, or other members of your family. Now what is the solution of this problem which we, as the medical profession, must face and try to solve?

The first reason which has been mentioned is your fault and it is not your fault: pathologists are rare and becoming rarer, I believe, for several reasons: many pathologists have been attracted to serology, immunology, and bacteriology because they are new sciences and apparently offer greater fields for investigation. The pathologist, being of a rather retiring disposition, has not seen fit to force his wares upon you and demonstrate his value. You have, as practitioners, not morally or financially encouraged young men to stay in pathology; tissue pathology is also a new science and is the victim of much observation, chaotic nomenclature, multiple classification, and crude methods of studying tissues; the pathologists who are at the top today are necropsy pathologists and know little about fresh tissues. Most of them are teachers and spend too much time in teaching bacteriology, serology, immunology, hygiene, and sanitation to devote enough time to tissues to become authorities in the modern sense.

The second reason may be due to that lethargy which exists among all classes of human beings; it is not characteristic, alone, of the medical profession.

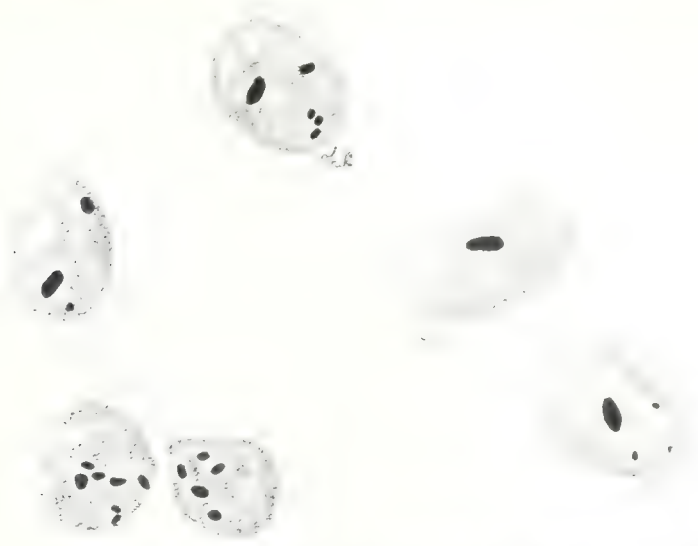

Fig. [illegible] fresh tissues with the oil immersion lens.

The third reason may be explained as was the first.

The fourth is worthy of a few facts; it is a form of overconfidence from which many surgeons, even good surgeons, suffer. By way of clarification some figures might be stated. In a series of 60,645 general patients, 24,368 (40 per cent) came to operation, and 21 per cent of all patients presented surgical pathological specimens of which 21 per cent required a microscopic examination before the correct diagnosis could be made, and before scientific thereapeusis could be administered. Six and eight-tenths per cent of the specimens removed at operation were removed for diagnostic purposes before further operative procedures were carried out. Perhaps, you, as surgeons, are great gross diagnosticians but, if so, you must account for the 21 per cent of diagnoses which must be made with a microscope. I know of a surgeon who, at the end of the week, examines all of his own specimens; this is very commendable, but if he picks up a mistake he must submit his patient to a second operation, a point in efficiency which might be improved on from the patient's standpoint.

The fifth reason is legitimate if you have clearly and completely endeavored to convince yourself, to the fullest possible extent, that frozen sections are not to be depended on. There are some things about frozen sections which must be put down as essential: Good reliable frozen sections cannot be made from tissues that have been dead much over an hour. In fact I have seen cells disintegrate

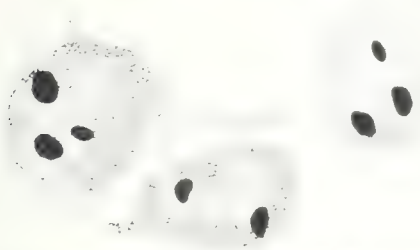

Fig. 3. Cancer cells in the uterus as they appear in fresh tissues with the oil immersion lens.

Fig. 4. Intra-acinic hyperplastic cells (secondary cytoplasia of MacCarty) in fresh tissues in the breast.

Fig. 5.—A cyst (a) in the breast associated with a small extracystic stellate carcinoma (see arrow).

in less time; they must not be fixed; they must be cut with a sharp knife; and they must be handled in normal saline, and mounted in such an isotonic solution as Brun's glucose. When made by this method the cells are more beautiful than any fixed and embedded cells I have ever seen (Figs. 1, 2, 3, and 4). There is just as much difference between studying such cells and fixed cells as there is between studying stuffed bird skins and the birds in the trees. It is certain that a knowledge of fixed tissues will assist one in understanding the unfixed fresh tissues but the cells are very different. A pathologist who has had all of his training with fixed tissues will undoubtedly have some difficulty with unfixed fresh tissues just as an ornithologist who has been trained only with stuffed skins will have difficulty with birds in the trees. However valuable both fixed tissues and stuffed skins might be, I feel about the tissues as I would about birds if I were an ornithologist; I should prefer to obtain knowledge from things as they are in their living state, or as near the living state as possible.

The sixth reason, why you might not give your patient the benefit of improved efficiency deserves a suggestion. If your practice is not large enough to afford a pathologist then you might join your forces with one or more surgeons, especially those practicing in your hospital, and have a pathologist together.

The seventh reason, your dependence on the hospital for your pathologist, might be considered a legitimate one provided you try to assist and influence your hospital authorities in their attempt to see the value of one. In this day of standardization of hospitals many are endeavoring to obtain good pathologists; the demand is much greater than the supply. Perhaps your hospital has tried; have you suggested that some young man be trained for the position? Have you attempted actually to make such a position attractive, or have you simply thought of it as a fine thing but have not utilized your ability to execute your thoughts?

The eighth, and last, reason you have a certain amount of justification for, although there is no reason for losing faith in the whole field of pathology or in all pathologists. Pathology, as a science, is very young—not within five hundred years of being as old as surgery. It had its real inception in the middle of the nineteenth century; your profession is as old as human written history. Yours is not yet perfect; you can hardly expect pathology to be perfect. It has grown out of a comparatively recent German rejuvenation of the ancient Greek method of making observations, giving names, and making classifications without much attempt at correlation. As a result, names for pathological conditions, especially neoplasms, are quite different in different lands and textbooks. There has been no great principle upon which pathology might be made an exact science. This we hope will be one of the products of the twentieth century. It is possible that it will grow out of seeing cells as they are in the body; and perhaps modern operative surgery will be the condition which will bring forth a new epoch in the history of our youthful science.

Now that we have seen the reasons why you have not a surgical pathologist and shown

line the ducts and acini.

that there is a certain significant percentage of your patients in which he can, and should be, of service to you and to them, I must tell you some of the requisites which you and your pathologist must possess in order to make a combination successful. The man you select to become your surgical pathologist must first be young; he must be interested primarily in doing something for your patients; he must have some knowledge of the principles of surgery and surgical technique; he must be interested in studying pathology for the benefit of your patients while you are treating them. He must realize that his work requires speed just as your operative procedures require speed; he must, however, be enough of a man never to sacrifice accuracy for speed; when he does not know he must be willing to say so; if he cannot make a diagnosis he must never guess. He must be present constantly while you are operating and must have access to all your clinical data, the patient, and your experience and judgment. As one well-known surgeon has said: "The pathologist is not a clairvoyant; he must have the facts." With these qualifications he can be of great value. If he happens to be endowed with the desire and ability for scientific investigation, his field is unlimited; there are new things to be discovered and methods to be improved in tissue pathology. Chiari, the last of the Rokitansky pupils said: "Die Pathologie der Gewebe ist in Ihren Anfang," and this, I have found in my experience, to be true. There is so much to be done that it is staggering to any one who is trying to do it. Your reports of your cases will be more complete and your own interest made greater if you have the proper man as your associate. Since it takes two individuals to make this combination work efficiently and since you, as the surgeon, are a part, there are some things which must be required of you: You must be generous and charitable; you must not only assist but you must encourage your surgical pathologist. Do not slur at his diagnoses when they differ from yours. If he is incorrect, as doubtless he will be sometimes, remember that you have made mistakes and he knows it just as well as you do, sometimes better than you do. If you find something interesting or unusual while you are operating or perhaps in your reading, always call his attention to it. He may not have time to utilize it at the time, but if he is the right sort he will store it away in his mind or in notes for future reference, a reference which might some day reflect great credit upon you, your clinic, and the medical profession.

Now [illegible] standing between us let me tell you just [illegible] thing which is new in efficiency in diagnosis which the proper surgical pathologist might well try out. Let us suppose that you are

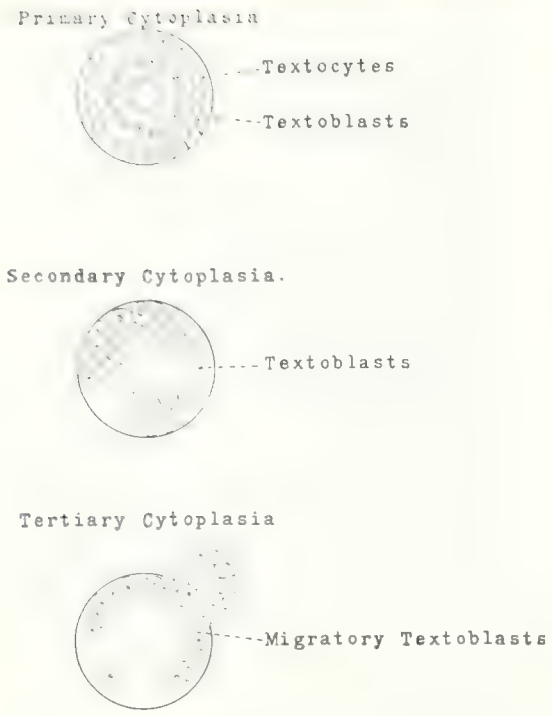

Fig. 7. Diagram showing the three histological pictures which are found individually or in combination in chronic mastitis. Primary cytoplasia is a normal condition. Tertiary cytoplasia is malignant. Secondary cytoplasia is a neoplastic condition in which the cells have not invaded the stroma. The cells in secondary cytoplasia are morphologically identical with cancer cells.

dealing with a pathological condition in the breast and that you believe the figures which have been presented here relative to your efficiency in clinical diagnosis. If the breast, regardless of the age of the patient, shows the presence of a tumor, associated with dimpling of the skin, fixation, and discoloration and no signs and symptoms of acute inflammation, you may safely make the diagnosis of a malignant condition, but all malignant conditions in the breast do not show all of these signs and many show none of them, a group which is becoming larger as the public and family physicians become educated. Many cases of diffuse chronic mastitis are associated with carcinoma of which there are no local palpable manifestations, and many benign palpable tumors such as fibro-adenomata and cysts are associated with minute carcinomata (Fig. 5) which may easily be overshadowed and missed by too much attention to the tumor itself, and too little search of the whole specimen during the operation. In doubtful cases I, personally, do not believe it is fair to perform a radical operation, but it is fair, with our present knowledge, to remove a sector (not a section) of the mammary gland-bearing structure for immediate examination. The postoperative studies made by Sistrunk and myself do not reveal anything detrimental to the patient by this procedure even when cancer is present. Such a specimen can be studied carefully for three definite histological pictures which, whether the general pathologist accepts them or not, have the greatest practical value and are based on tangible biological facts. Thus the lining of the ducts and acini of the breast consists normally of two layers of cells (Fig. 6). Sometimes, in chronic mastitis, which is always present in carcinoma in my experience, the inner row of cells is partially or completely destroyed, and is associated with an hyperplasia of the outer row of cells which are morphologically identical with the cells of cancer. Whether or not they are cancer I do not know but sometimes these same cells are found not only in the acini or ducts but also in the surrounding tissues, a condition which any pathologist would be willing to call cancer. If your pathologist finds the two layers of cells (Fig. 7) he is dealing either with a normal condition or one in which there is a reaction to some disturbing factor. The condition of these cells varies in their relationship to each other so far as size is concerned, but the general presence of the two layers is indicative of a benign condition when seen, and a radical operation is unnecessary. On the other hand, however, if the hyperplastic cells of the outer row have invaded the stroma there is no doubt that a malignant condition is present and that, with our present knowledge, a radical operation should be performed. The condition, in which the hyperplastic cells have not invaded the stroma (a diagnosis which should be made only after the most thorough and detailed microscopic examination), is one open to question. Should we or should we not per-

form a radical operation? My experience to date seems to indicate that the removal of the mammary gland-bearing structure is all that is necessary. I have never seen a recurrence after such an operation. We have seen, therefore, that there is something new in surgical pathology and that something new has evolved out of the association of a pathologist with the surgeon. It is just such types of service which the surgical pathologist can and should render you and your patients during a single operation. By this means the 5.5 per cent of mistaken diagnoses, the 21.5 per cent of doubtful diagnoses, and the necessary 21 per cent of microscopic diagnoses can be taken care of efficiently without the slightest detriment to your patients.

In conclusion may I state that the medical profession, as a whole, has not reached its greatest efficiency in the diagnosis of neoplasms, but that we have a method by which our efficiency can be and should be increased. All that is lacking to make the diagnostic efficiency greater, in practice, is your encouragement in the making of surgical pathologists with the ideals which have been enumerated. If all surgeons were to spend the next 5 years trying to follow out the plan presented here we would be able to render the public service of which we might well be proud. If we do not, then we must go along in the same guessing fashion, which I know is not the desire of the majority of the profession. What has been said of the breast is quite as true of the other organs and tissues of the body.

ROUND WORM (ASCARIS LUMBRICOIDES) IN GALL BLADDER

By A. P. BUTT, M.D., F.A.C.S., Elkins, West Virginia

THE tendency of this parasite to migrate is known to all physicians. The *Index-Catalogue of Medical and Veterinary Zoology* contains nearly five pages of references labeled "erratic, found in, migrations of." Likely it was one of the very first parasites to be observed by the early physicians, yet even now some points in its history remain more or less in doubt, or at least disputed. Of these I note the following: age; life cycle, presence or absence of intermediate host; harmful or harmless.

I have been unable to find any estimate of its age. They are said to obtain sexual maturity 10 or 12 weeks after the ova have been swallowed (1). Taylor and Freeman say there is no intermediate host. Huber (2) says: It may be positively affirmed that ova which contain embryos and which are still surrounded with the mulberry envelope, will develop into round worms in the human intestine." Professor Stiles (3) says: "The eggs of the ascaris will not hatch as long as they are in the human body. They must pass out and there undergo their changes. The young worm is developed inside the egg, the egg is then swallowed, hatches out in the stomach, crawls through the wall of the stomach, gets into the circulation, goes to the heart and lungs, up the trachea, down through the stomach to the small intestine, there develops further."

It seems incredible that any dispute concerning its power to harm should ever have existed, yet such is the case. Of its alleged harmlessness Huber says: "This may be true in certain instances among children of the better classes in the cities with good water supply; but one engaged in country practice . . . will soon be persuaded that the alleged harmless guest is often the cause of fatal disturbance." In three cases of my own, operated upon for appendicitis I found the round worm once, twice I found seat worm (ascaris vermicularis). Schloessman (4) reports eleven cases in which operation was required for evil done by ascarides. If at operation the worms are found *inside* the gut he strongly advises against opening it. Let santonin do the work.

The literature is replete with reports of the presence of this parasite in the biliary ducts Huber, in his bibliography, reports 68 cases of invasion of the bile ducts. In one case the number of worms that had passed up from the intestine was eighty. The ova have been found in the ducts and in the gall bladder and worms as small as 1¼ inches have been found (5). It is true these worms were found at necropsy and, therefore, the evidence is not quite so convincing as if found during life.

Rokitansky (6) reports an interesting case in a cretin of 9 years. The hepatic and common ducts were sausage-shaped, more than an inch in diameter, and filled with worms. They had found their way into the smaller ducts; two were found in the duct of Wirsung.

A. Degorce (7) reports a case of violent hepatic colic recurring for 7 years. At operation many biliary calculi were removed from the common duct. Operative recovery with death 6 months later from pulmonary tuberculosis. Necropsy showed about forty stones in biliary passages, all of which contained eggs of the round worm. On section one of the largest stones contained a filament 1.5 inches long which proved to be a small ascaris. Notwithstanding the numbers of this parasite which have been found in the biliary passages, the occurrence of a living worm in the gall bladder during life seems to be rare. After a search, which, however, was limited, I found but one such case. When we take into consideration the character of the passage through which it would have to travel to gain admittance to the gall bladder this is not to be wondered at.

Deaver (8) says: "In a normal condition of the duct it is impossible to carry the smallest probe through it, owing to its double course and the peculiar condition of its mucous lining."

D. Eberle (9) reports a case in a boy of 9 who had been treated with santonin for helminths. Five months later there was jaundice and pain, at operation a round worm was found in the gall bladder and three more in the hepatic duct, all alive. Two more were extracted from biliary passages 11 days after operation. This last statement indicates either a drainage operation or necropsy.

Mrs. C. C., white, American housewife, age 30, mother of three children, youngest two, entered the Elkins City Hospital, August 30, 1921, for relief of severe pain in the right upper quadrant, of 6 days' duration. Her first attack of a similar nature had been in 1919. Since this she had had 5 like attacks. A diagnosis of cholecystitis with probably presence of calculi was made.

Operation disclosed a distended gall bladder which could not be emptied. Otherwise it differed little if at all from normal. An opening was made in the gall bladder, and at once a round worm of about 6 inches in length made its appearance. It was thrown on the floor where it crawled around quite vigorously. I regret that no effort was made to ascertain its sex. No calculi were found. Both gall bladder and abdomen were closed without drainage. In a letter dated December 29, 1921, the patient writes me that she passed many worms previous to operation, none since. She declares she is perfectly well and that she has had no pain since operation.

Since we know from Degorce's case that the eggs may become a nidus for the formation of stones it seems to me to be better treatment to perform a cholecystectomy or a cholecystostomy than cholecystotomy.

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DEPARTMENT OF TECHNIQUE

RADIOTHERAPY IN CARCINOMA OF THE BREAST[1]

By GEORGE E. PFAHLER, M.D., Philadelphia

THE surgeons deserve great credit for the thoroughness with which they have studied carcinoma of the breast. Books have been written by such masters of the subject as Bryant, Deaver, Handley, Lewin, Rodman, Shield, and Williams. In fact, practically all that is known about carcinoma of the breast has been studied and written by the surgeons and the pathologists. Their information has been obtained by actual touch and sight, and at first hand. The surgeons have carried this same thoroughness into their operative technique and have made their excisions more and more extensive, with the object of eliminating every particle of disease. Yet at present practically all surgeons acknowledge that they have reached their limit, and the limit to which surgery can go. Even with all that has been accomplished by surgery; there is much left to be desired. Deaver says: "We can never be sure that every malignant cell has been removed, however early and well localized the disease seems to be at the time of operation, nor do the most complete operative procedures in such cases insure freedom from recurrence. When the disease is localized to a small area of the breast and the case is in other respects a suitable one for operation, we may be lead to hold out the hope of surgical cure; only to have the patient die of early metastatic involvement of the viscera.

Even with the best operative technique, and in the most skillful hands and the greatest care, the actual operative mortality is about one per cent. Of the patients that come for operation or that come to consult the surgeon 25 per cent are probably inoperable. If the patient is in the hands of a skillful surgeon and is operated upon before the disease has extended to the axilla or before metastasis has taken place, in other words if by microscopical studies the disease is found to be confined to the breast, four out of five patients will live, and be free from disease at the end of 5 years. If the disease, however, has spread from the breast and has extended to the axilla or anywhere else, not more than one out of five will be cured. Therefore, when the subject is studied as a whole, it is found that only [illegible] patients out of 100, as they come, have a chance for cure by surgery alone, and the other [illegible] be expected to die of carcinoma. Therefore, with all that has been accomplished by surgery, there is much to be desired, and any means of treatment that can be combined with surgery or used independently to cure or give hope of curing the 75 per cent that will otherwise die, should be used with all the earnestness at our command.

Radiation in the treatment of carcinoma of the breast is not new. The roentgen-rays were first used in the treatment of carcinoma of the breast in 1897 by Gocht, Katzenberg, and Derks. Since then there have been hundreds of records made. My first report on the treatment of carcinoma of the breast was made in 1902, and I have had an experience with approximately 500 cases since that time, or to be exact 578. When I was first invited to present this subject it was my ambition to review all of these cases and to trace as far as possible the patients dead or alive; so that I might determine if possible whether our radiation treatment has had any influence whatever upon the end-result as studied statistically, but after analyzing the first 150 cases that had been treated previously to 1918 and taking them in alphabetical order I concluded that the task was too stupendous for the time at my command. I am hoping still to complete this review, at least for my own satisfaction. I doubt very much, however, that such a review will give us much that is of value from a statistical standpoint, because the units that make up the statistics are so irregular that the total must be almost worthless. As we look at the subject today, the technique that we used in the early days was so imperfect that it is surprising that any results, even though temporary, could be recorded. Yet, even in those early days, we saw primary tumors shrink and recurrent masses disappear. Generally the patients that were referred for treatment, if primary, were extremely far advanced. The recurrent cases were generally referred for treatment after the recurrences were extensive and

Read [illegible] Medical Association, June 3, 1920.

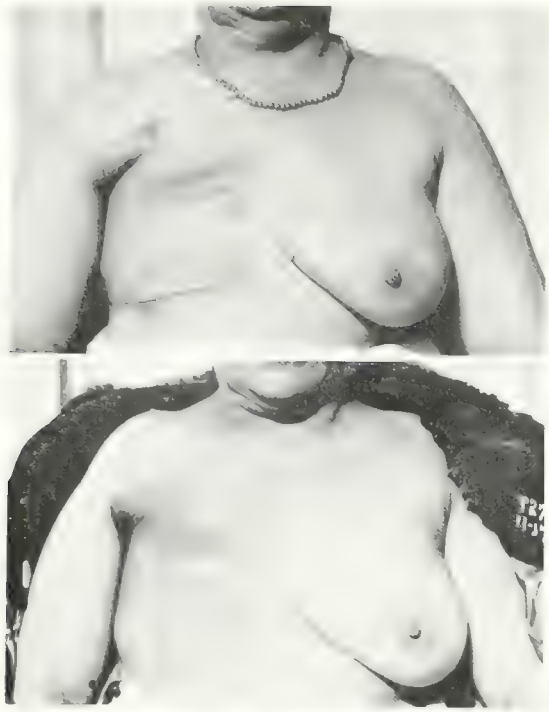

Fig. 1 (a above). Case 5. Showing recurrent nodules in the operative field and swelling of the sternum.

Fig. 1 (b). Case 5. Showing complete disappearance of these recurrent nodules 6 months later, and the patient in good general health. She has remained so to date, January 18, 1922.

had existed for several months. With regard to the postoperative cases, only the extremely bad ones were sent to us and I have felt that many were operated upon because they hoped that the X-rays would permit the operation which otherwise would not have been undertaken. To a great extent these criticisms are still true. Our technique is far from perfect, though I would estimate that it is a hundred times better than in the earliest days. The postoperative cases are still of the advanced type and statistics will not be of great value until the surgeons make it a rule to give postoperative treatment to every patient, and to classify the patients very carefully. In fact the radiologist should be permitted to see the patient with the surgeon before operation; so that they together could decide upon the best course of treatment.

Radium and the X-rays are only instruments or remedial agents. They require both skill and keen judgment in their application, if the best results are to be accomplished. Such judgment and skill can only be used to best advantage if the radiologist has the opportunity of knowing the conditions at the start. If we can ever get this combination or co-operation between the surgeon and the radiologist, I am quite sure that statistics will prove the value of such combination; that the surgeon will be convinced of its value and the mortality rate from cancer will decrease.

Radiotherapy in carcinoma of the breast may be considered under three headings: ante-operative and postoperative treatment, the treatment of recurrences and metastases, and the treatment of primary carcinoma of the breast.

Ante-operative and postoperative treatment of radiation in cancer of the breast. The object of the ante-operative treatment is to devitalize the cancer cells so that they cannot easily develop locally or so that they cannot easily grow if transplanted during the process of operation. Numerous experiments to show that such action takes place in cancer tissue exposed to the X-ray will be found recorded in the book by Colwell and Russ on *Radium and X-rays, and the Living Cell.* In a series of experiments made by Wedd, Chambers, and Russ with an adenocarcinoma of the mouth, they showed definitely that this devitalizing effect takes place. A thin slice of tumor about 2 millimeters thick was placed between two sterilized sheets of mica. The tumor was moistened with normal saline and enclosed by a vaseline ring which prevented evaporation. This was placed between two radium capsules, giving an intensity of radiation equal to 2.2 milligrams of radium bromide per square centimeter. An initial exposure, lasting 4 hours, to the composite rays from the radium prevented the subsequent growth of the tumor when it was transplanted into five mice, a control portion of the original tumor "taking" in all of the inoculations.

Nogier, Jaubert, de Beaujeu, and Contamin have shown the direct effect of X-rays upon the cells of a mouse tumor, an epithelioma of glandular type (adenocarcinoma). The tumor upon removal from the animal, was minced and then exposed to X-rays, after which it was inoculated into normal mice to see whether it would grow. When using rays of a quality of which 50 per cent were absorbed by the tumor tissue, they found no positive, and fifteen negatives; while the controls gave 14 positives and one negative. The authors conclude from these and similar observations that the action of the rays is rather to hinder the subsequent growth of the tumor than to prevent their taking on inoculation, for though the percentage of successful inoculations

Fig. 2 (a). Case 5. Destruction of lower two-thirds of sternum by metastatic carcinoma, May 24, 1921.

Fig. 2 (b). Case 5. Showing [illegible] the sternum and healthy [illegible]

may not be much reduced, the rate of growth of the tumor is much lessened.

Technically it is probably impossible for us at present to carry rays into the tissue in such a manner as to have 50 per cent absorbed by the tumor. We have many technical difficulties to overcome in order to carry our radiation into the deeper tissues sufficient to destroy the cancer cells without doing damage to the overlying tissue. Otherwise there would be no question as to the efficacy of radiation treatment. Francis Carter Wood has done some interesting experiments on mice, with mouse carcinoma. At the recent meeting of the American Radiological Society, he made the statement that it took six erythema doses to kill all of the cancer cells, but that a sublethal dose will retard the development of an inoculated carcinoma for a period of three months, that is, that while in an ordinary inoculation of a cancer of the mouse, in which there is 100 per cent of "takes," the tumor will develop to the size of a pea in a week. If it has previously been given a sublethal dose of rays it will require 3 months before this tumor develops to the size of a pea.

All radiologists have seen malignant disease disappear under the influence of radiation. Everyone recognizes the destructive effect the rays have upon malignant cells. Therefore, since those clinical observations and experimental investigations show a devitalizing effect upon malignant cells, we are justified in recommending that the rays be used for this purpose preceding operation, as I have been doing for a number of years. We all know that with the photographic plate the effects of light are not shown until the plate has been developed, but we also know the effect of the light only lasts while the shutter of the camera is actually open and ends as soon as the shutter is closed. So too with the malignant cell, the effect of the rays takes place while the tissues are actually under its influence, and the total effect has been produced as soon as the current of electricity has been turned off from the X-ray tube, though its beginning effect cannot be shown microscopically for a period of one to two weeks, and the effects will vary from this time forward, depending upon the time at which the microscopical examination is made. Since the effect on the cancer cells is ended as soon as the

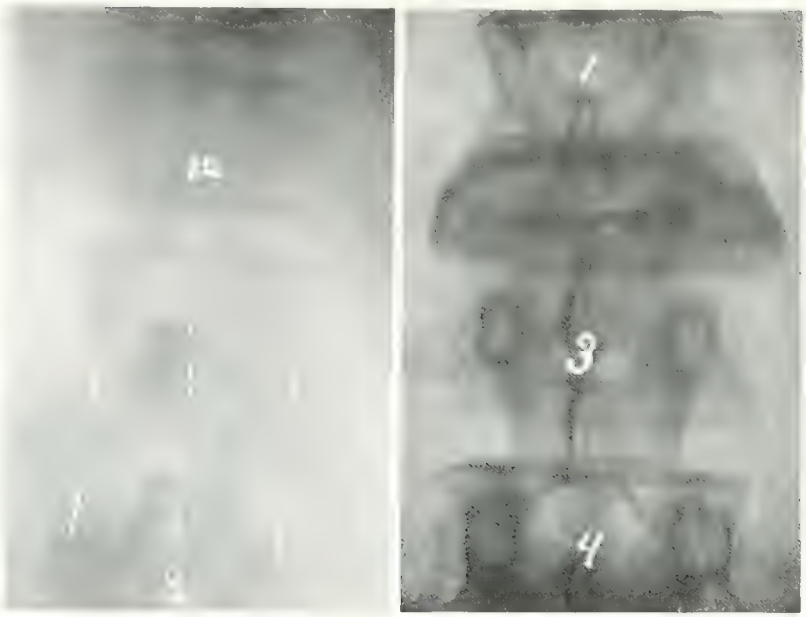

Fig. 3 (a, at left). Case 3. Showing complete destruction of the second lumbar vertebra by metastatic carcinoma, March 27, 1918.

Fig. 3 (b). Case 3. Showing complete recalcification of the second lumbar vertebra under the influence of X-ray treatment.

radiation is stopped, theoretically one would be justified in operating the next minute. Theoretically, it would be desirable to give a massive dose of radiation over the mammary region and the glandular areas leading therefrom at a single sitting. It would be desirable to carry into all of these tissues the greatest possible amount of radiation which can be tolerated by the skin, producing as great a relative depth dose as is possible during the shortest period of time, and then it would be desirable to operate immediately after this. While this is good in theory its practice at present is impossible. With our present technique, such treatment would require approximately four hours' exposure. If this were done, one would expect great prostration from radiation sickness. Some patients do not develop radiation sickness, but none of us can tell which ones will. At any rate such radiation sickness would make the patient unfit to go through with an operation at this time. Therefore it is my practice, at present, to utilize approximately 2 weeks for this ante-operative treatment, and at the end of these 2 weeks, so far as my observations go, the patient is in fit condition for operation and has suffered nothing from the preliminary radiation.

The postoperative treatment is then begun about 2 weeks after the operation, in other words about 4 weeks from the beginning of the radiation. The object of the postoperative treatment is further to devitalize the cancer cells and to prevent the growth of the newly implanted tumor or of the remaining cells which may not have been reached by the surgeon's knife. That is, the rays tend to further devitalize the metastatic lymph nodes in the neighborhood of the tumor and gradually to encapsulate them by fibrous tissue. Apolant, in 1904, was one of the first observers of the effect of the rays from radium upon tumors in mice. Irradiation of the tumor *in situ* resulted in many cases in its subsequent disappearance. The exposures were carried out with 20 milligrams of radium bromide and applied to the surface of the tumor 10 to 12 days after the inoculation of a graft. The radium preparation was covered with mica, so that the effect obtained was probably due to the β-rays, which would correspond approximately to the X-rays in their penetrative power. Two carcinomatous varieties of tumors were observed under these conditions with adequate control. Out of 19 tumors treated for various periods of time, 11 disappeared and a diminution occurred in the remaining 8. Of the 17 controlled tumors, 2 suffered spontaneous absorption and the remaining 15 showed progressive growth. Apolant concluded on histological

grounds that the destruction of the carcinoma cells was not a sequel to the proliferation of the connective-tissue cells, but that it was due to a direct action of the rays upon the parenchyma. Contamin has exposed tumors in mice to X-rays under various experimental conditions, and records some interesting results. The tumor selected was a carcinoma of glandular type. The mice bearing the tumors were placed at a distance of 12 centimeters from the [illegible] bulb running at 9 to 12 centimeter spark gap, the rays being filtered through 0.2 millimeters of aluminum. Tumors as large as the mice bearing them were eventually seen to disappear after they had received an exposure of 1 hour. Tumors in a stationary condition were not affected in any way by such treatment. As the result of a number of observations by Contamin he came to the following conclusions: (1) the action of X-rays is the greater, the younger and more actively growing the tumor is; (2) the disappearance of a large tumor causes the death of the animal, probably by intoxication. The disintegration product of the cells which have been injuriously affected by the rays is eventually absorbed by the body; in the case of excessive quantities this leads to a state of intoxication.

All of us have seen recurrent cancer tissue disappear under the action of radiation. All acknowledge that the younger the tumor the greater will be the action upon the cancer cells. These clinical observations and the experimental evidence which has been produced argues strongly in favor of the postoperative treatment to be given just as soon as is practical after the operation, which is usually at the end of about 2 weeks. If no ante-operative treatment has been given and the treatment can be given in the hospital in which the operation has been done, I would urge that the treatment be given just as soon as the patient can be moved from the ward to the laboratory.

About 10 years ago, in connection with the late Dr. William L. Rodman, we treated a number of cases during the operation through the open wound with the skin flap thrown back and the entire wound covered with a wet sterile towel. Such treatment has the advantage of bringing the radiation in more direct contact with any cells that might be implanted in the open wound tissue, but of course it can have no advantage in the treatment of the cells located beyond the actual area of incision, nor can it have any advantageous effect upon the metastatic cells. It has the disadvantage of prolonging the [illegible] tion and thus prolonging the operation. It requires the joint action of the radiologist and the surgeon. After treating a number of cases in this way, we concluded that the disadvantages of [illegible] were greater than the advantages. We then began the postoperative treatment as soon as the patient could be comfortably moved to the X-ray laboratory.

[illegible]
tumor tissue.

The technique of this ante-operative and postoperative treatment will vary somewhat with the individual patient. Those who will take the trouble to compare will find my technique described varies from time to time, but radiologists will appreciate that the development of our subject or our speciality requires a change of technique, and it is likely that a year from now my technique will be different from what it is today. I cannot help this. It is our duty to keep abreast with the development of the scientific phase of our subject, and vary our technique in order to produce the greatest effect upon the diseased tissue with least effect on the healthy tissue.

For the ante-operative treatment I usually use three portals of entry for the rays, divided as follows: a line corresponding to a horizontal line drawn through the anterior surface of the

Fig. 5 (a, above left, and b, at right). Case 9. Carcinoma of the left breast. No palpable lymph nodes October 6, 1920.

Fig. 5 (c, below, left). Case 9. February 4, 1921. Entire mammary, supraclavicular and axillary region thoroughly saturated with X-rays, then local destruction of the projecting tumor by electrocoagulation and insertion of radium needles throughout the breast. Patient is free from any visible or palpable disease up to the present time.

chest on a level of the lower border of the axillary fold. A corresponding posterior horizontal line drawn through the level of the spine of the scapula. This gives the outline of the supraclavicular area to be treated. The area below the anterior horizontal line forms the upper border of the mammary area to be treated. The posterior border of this mammary area is marked by the mid-axillary line. The rays are then directed through each of the three areas bordered by these three lines, and directed toward the disease in the breast, the axilla, the supraclavicular and mediastinal regions. If one notes carefully, they will find that these rays are crossing to the greatest possible amount in the deeper tissues with the least waste of energy. I am using 6 millimeters of aluminum filter, 9 inch parallel spark gap, at a focal skin distance of 40 centimeters, for a period of 40 minutes. Each of these three areas is covered within one week, that is we try to treat the patient on alternate days. This is all that the patient can stand without producing radiation sickness. Each application is the equivalent of two-thirds of an erythema dose. Each of these areas is treated again during the second week so that the second radiation over each area is given a week from the first and each of the three areas receives two of these treatments within a period of 2 weeks. In other words 1⅓ erythema dose of deep radiation is given within a period of 2 weeks. If one adds to the direct action of the rays to these areas the secondary effect from the treatment through the other two areas, we must conclude that we are probably getting during this first 2 weeks approximately two erythema doses which is more radiation than could possibly be carried into the tissues by any other method. Some one may criticize this technique because a full erythema dose is not carried into each of these fields immediately, but by such process one would probably produce dermatitis and would certainly not be able to give more than half the amount of radiation within a period of a month. This technique has been developed after much experience but will probably be modified in the near future.

During the past year after giving the anteoperative treatment and the postoperative treatment as described, I have been seeing the patient once a month for observation only, and have not added any further treatment unless there was some sign of recurrence. Previously we have been in the habit of giving radiation over a period of 5 or 6 months, or during one or more years. Such procedures, however, have many disadvantages. It discourages the patient; it is indefinite; it is expensive and very generally the patient just interrupts the treatment, of her

own accord, after a time, and we lose track of the patient. It will be many years before we can definitely prove which is the best procedure, but it is my impression that what I have described above is the best technique known today.

The treatment of recurrent and metastatic carcinoma by radiation. I have previously written an article upon this subject and will, therefore, only discuss this briefly under this subheading. I think there can be no question but that recurrences and metastases are best treated by radiation. While some brilliant results are produced by this means and some cases that seem absolutely hopeless do recover and remain well, at least for a period of from 1 to 10 years, the majority of these metastatic and recurrent cases will die of carcinoma. In all instances according to my observation there has been a retardation in the disease, and at least temporary improvement. From the same condition that had brought about a metastasis or a recurrence there is liable to commence a deep metastasis elsewhere in the body, and though the metastasis that is brought under treatment at the beginning may disappear there is no assurance that such a metastasis may not develop elsewhere in the body. The most difficult problem for the surgeon, radiologist, and all of those who have to do with the treatment of cancer of the breast is to determine the extent to which metastasis has taken place. It is this difficulty that has lead to the many disappointments in the supposedly early cancers which were operated upon, almost immediately after the discovery of only a very small tumor in the breast, and yet in which metastasis had taken place and ultimately developed. So, too, a recurrent carcinoma in the operative field may only be an index of other recurrences which will develop later in other parts of the body. For this reason one cannot confine the treatment merely to the recurrence, but the entire operative field and the glandular distribution leading therefrom, at least, must be included in the treatment. In all cases of cancer of the breast that are referred to me, at the very beginning, I make a roentgenogram of the chest; and, as previously described by me, in about 50 per cent of these cases I find evidence of mediastinal or pulmonary disease. My estimate of the frequency of this mediastinal and pulmonary involvement may be too high, for at the beginning of this involvement, it is extremely difficult to make any definite diagnosis. In the advanced stage it is very easy. In many instances I have been able to follow the progressive development of this disease within the thorax. For this reason one must always give

Fig. 6 a, above. Case 12. Mar. [illegible], 1911. Scirrhous carcinoma of the left breast, ulcerated, adherent, palpable metastatic lymph nodes in axilla. Thorough saturation with the X-rays over the mammary, supraclavicular, and axillary region followed by insertion of radium needles.

Fig. 6 b. Case 12. June 1, 1911. Complete healing. Patient is still well, or free from palpable or visible disease.

close attention to the mediastinum, as well as the liability of the disease extending downward toward the liver. In general I try to get two or three erythema doses of rays into the recurrent tissue within a period of 2 weeks, and I try to get two or three erythema doses into the metastatic nodules within a period of about 2 weeks. In some instances, it is practical to follow this with the introduction of radium needles directly into the metastatic nodules, or in other instances, it is practical to make prolonged surface applications of radium, filtered in such manner as to give only general radiation. Such methods of treatment sometimes produce very brilliant results. The following are a few illustrative cases of results that may sometimes be obtained in the treatment of recurrent and metastatic carcinoma of the breast.

RECURRENT CASES

Case 1. Mrs. E. F. B., age 71, referred by Dr. John B. Deaver, November 14, 1910, on account of recurrent carcinoma, [illegible] doing [illegible] on account [illegible] of the

posterior portion of the axilla. She also had a palpable [illegible] in the left supraclavicular region. She had been operated upon for carcinoma of the breast in March, [illegible] and had discovered these recurrent tumors only [illegible] weeks before. She was given all the radiation that her tissues would stand during 5 months. She has not been treated since and is well September 16, 1921, with some [illegible] metastasis of the skin. This is 8 years after the treatment of recurrences.

Case 2. Mrs. W. H. A., age 60, was referred by Dr. John B. Deaver, January 13, 1914, for treatment of recurrences in the scar after amputation of both breasts February 23, 1913. She was given all the treatment the tissues would stand during 5 months. She is well December 28, 1921, 8 years after treatment of recurrences.

Case 3. Mrs. R. C., age 61, was referred by Dr. Ernest Laplace, October 29, 1903, for treatment of recurrent nodules in the mammary region, enlarged metastatic lymph nodes in the supraclavicular region. She had been operated upon for carcinoma of the left breast by Dr. Laplace 3 years previously. She suffered much pain in the arm, and partial paralysis. She was treated to the limit of skin toleration, was made comfortable, traveled to California, and to Egypt. The nodules never completely disappeared. The patient died with diarrhœa October 25, 1910, about 7 years after beginning treatment for extensive metastasis.

Case 4. Mrs. S. P., age 43, referred March 27, 1918, by Dr. C. C. McCormick for treatment. Dr. John B. Deaver had amputated the right breast, March, 1917, or approximately a year before she was referred to me. During 15 weeks before she was referred to me for treatment she had been bedfast on account of pain in her spine. X-ray examination on March 27, 1918, showed complete destruction of the second lumbar vertebra and almost complete destruction of the eighth dorsal vertebra. Active X-ray treatment was given and a celluloid cast was made to support the spine. Within 6 months the spine had shown marked evidence of recalcification and the patient was doing all of her housework including her washing and ironing, and has done so ever since. It is now nearly 4 years since she came to me bedfast, and there has been complete recalcification of these vertebræ.

Case 5. Mrs. E. J. D., age 40, was referred to me for X-ray treatment May 5, 1919, by Drs. A. R. Easby and Caroline Purnell. She had had an amputation of her right breast for carcinoma on April 12, 1919. The tumor had been growing 18 months before operation, and there was metastatic axillary involvement. There were also palpable supraclavicular lymph nodes, and the upper mediastinal tissues were thickened. We gave the patient three courses of treatment in 1919. She then discontinued treatment against our advice. On May 24, 1921, or approximately 2 years later, she was sent back to me for treatment by Dr. C. S. Tuttle, at which time there was a recurrent nodule, 2 centimeters in diameter, at the lower and inner end of the incision and a nodule 2 centimeters in diameter at the anterior border of the axilla. These were undoubtedly malignant. There was also general puffiness in the anterior axillary fold, tenderness and swelling over the sternum.

X-ray examination showed destruction of the lower two-thirds of the sternum by carcinomatous disease. Under X-ray treatment these nodules completely disappeared and the sternum has recalcified. This healing process has taken place within a period of 5 months, and so far as we can see, the patient is well. These latter two cases are probably unusual in their results, but it shows that the radiation treatment is not confined in its effect to the superficial tissues.

The treatment of primary carcinoma of the breast by radiation. As a whole we have had comparatively little experience with the treatment of primary carcinoma of the breast by radiation, because we have tried to urge operation in all cases, just as the surgeon has taught us to do. I am not prepared to recommend a change in this procedure even now, though the results which we have obtained during the past two years with the combination of the treatment with the roentgen-rays and radium justify serious consideration of this subject. In most instances the cases of primary cancer of the breast that have been sent to us for treatment have been the totally inoperable and very advanced cases. Most of them have been inoperable because of the advanced disease. Others have been inoperable because of some complication. In nearly all of these cases the patient has received comfort, consolation, and prolongation of life.

Some time in the future we will be able to draw conclusions from statistics as to the relative prolongation of life from operation and radiation, but at present it is impossible because no group of corresponding cases has been treated by each method. Even in the future it will require a large number of cases studied jointly by both the surgeon and the radiologist and in which great care is taken as to classification. All of us have seen the healing of ulcerative primary carcinoma under the influence of radiation. We have seen the tumor tissue reduced and at times completely disappear. We have seen metastatic nodules disappear. We have seen the tumor tissue reduced to a fibrous mass which makes the inoperable case operable. There can be no doubt in the mind of any reasonable observer that the radiation has pronounced effect upon cancer tissue. We have also seen a supposedly incurable patient get well and remain well for years. Even such results, however, cannot justify the conclusion that we can replace surgery. In some instances we can cause the complete disappearance of the tumor tissue and the probable metastatic lymph nodes. In others we bring about the disappearance of the metastatic lymph nodes and the tumor tissue is reduced to a mass of scar in which it is impossible to determine if any malignant cells are remaining or not. Such patients can sometimes be cured by the removal of this malignant tissue

Boggs has been recommending the primary treatment of carcinoma by radiation until such effects are produced, that is until the metastatic lymph nodes are made to disappear and until the tumor tissue shrivels to a fibrous mass, and

then he has been requesting the removal of the local tumor tissue. This form of ante-operative treatment differs from that which is previously described by me, but there is much to recommend this latter procedure. In this latter instance one works not only for the direct action upon the cancer cells, but for the effect of the fibrous tissue, which chokes off the cancerous cells into small nests. In all instances when there is any tumor tissue remaining after radiation the safest procedure is probably to recommend its complete removal.

No definite technique can be described suitable to all cases. One must vary the technique according to the amount of the disease and its distribution. In all instances one can only speak of general technique, for no two machines give exactly the same output, and therefore, technical details cannot be literally transferred and reapplied blindly on some other machine. One should learn the erythema dose time of a given amount of current, at a given spark gap for a definite distance of each particular machine. Then from this erythema dose value, one can by calculation arrive at the proper dosage for the individual case.

In a primary case with or without metastases in the axilla, I should give preliminary roentgen radiation, very similar to that previously described as pre-operative treatment. Then at the end of two weeks, if the patient cannot be operated upon, radium needles can be imbedded into the diseased area. Ten milligram needles can be introduced at a distance of 1 centimeter apart covering the entire diseased area and the metastatic lymph nodes and left in place for 8 hours or they can be inserted 1½ centimeters apart and left in place for 16 hours. I believe it is unwise to allow the needles to stay in place longer than 16 hours. Even when they are left in place for this period of time they produce a violent local reaction which is followed by the formation of fibrous tissue and an actual little fibrous nodule is formed at the point of greatest radiation effect of each of these needles.

It is very difficult for any one to say absolutely when the diseased tissue has disappeared and when the nodules are entirely due to the action of the radium needles. This is additional reason for the removal of the breast after the malignant disease has supposedly been destroyed. I have introduced radium needles into the lymph nodes in the axilla and in the supraclavicular region with apparent success. I realize the difficulty of such procedure and I believe it cannot be universally recommended. One must not be foolhardy and should avoid the insertion of the radium needles into large vessels or nerves. The following cases will illustrate the results that are sometimes obtained in the treatment of primary cases.

PRIMARY CASES

I will describe a few illustrative cases briefly.

Case 6. Mrs. A. J. B., age 44, referred for treatment August 24, 1912. Found a lump in her breast and noticed it was in the breast during pregnancy. She was operated on for a malignant [illegible] She had a recurrence in the upper outer quadrant of the breast. She was given six series of treatment, with nine doses in each series, during a period of 3 months. Complete disappearance of all tumor tissue. She has remained free from any evidence of disease about two and a half years.

Case 7. Miss E. A., age 30, was referred by Dr. Nicholas Mitchell, February 25, 1913. On January 1, 1913, she had a fall injuring her right arm. Two days later she noticed a tumor in her right breast. I found a tumor two and a half inches in diameter, irregular in outline and nodular. She also had palpable, hard lymph nodes in the right axilla and the supraclavicular regions. The tissues of the breast and glandular region were kept saturated to the limit of skin toleration for a period of 4 months when all palpable evidence of disease had disappeared. She has had no treatment since. Since then she has been married, and is reported well January 15, 1922, or approximately 9 years.

Case 8. Miss M. O'B., age 65. Referred for treatment March 12, 1921. She had noticed a tumor in her breast 4 years, gradually growing larger, especially during recent months. There was no pain. There was formed a palpable tumor in the left breast, oval in shape, 5 inches long and 3 inches wide, extending from the nipple toward the sternum. No palpable lymph nodes were found in the axilla, but an abnormal shadow was seen in the upper mediastinum. She was given thorough preliminary roentgen-ray treatment directed toward the breast, axilla, supraclavicular region, and mediastinum. Then 200 milligrams of radium in the form of radium element in needles were introduced into the tumor tissue for 8 hours. She was treated first in May, and all evidence of [illegible] had disappeared. She has remained free from palpable disease. This case is of short duration, but it illustrates what I consider modern method of treatment.

Case 9. Mr. H. H. P., age [illegible], referred by Dr. Meyer Henry, October 6, 1920. Has had a tumor growing from the left breast and involving the left breast 5 years. A preliminary course of X-ray treatment was given as described above. A section [illegible] and found to be malignant. Then the tumor was destroyed by electrocoagulation and 150 milligrams of radium in platinum needles were introduced into the tumor tissue of the breast November 1, 1920. He was treated further by X-ray in November, and December, 1920, and none since. He has remained well to date.

This case is reported to show how electrocoagulation can at times be combined with radiation to destroy projecting tumor tissue.

Case 10. Mrs. F. W., age 59, was referred for treatment March 27, 1921, by Dr. J. S. Crater. She had had a tumor in her left breast 5 years. At this time, the nipple had sloughed away, and there was an adherent ulcer 1½ inches in diameter with induration of the [illegible] and [illegible] diameter. She [illegible]

X-ray treatment was selected for ante-operative treatment. [illegible] of radium element in needles was introduced into the tumor tissue for 15 hours on April 6 [illegible]. She has had no other treatment since and so far as we can tell she is well.

CONCLUSIONS

1. It has been shown that thorough radiation treatment of cancer tissue will devitalize the cancer cells so as to interfere with their inoculation or further development. This justifies our recommendation of ante-operative treatment.

2. It has been shown that radiation effects are most evident on new growing tumor and such radiation will prevent the growth of inoculated tumors. Therefore, we recommend active post-operative treatment in cancer of the breast.

3. Visible and palpable recurrent metastatic cancer are probably only an index of similar disease elsewhere, and therefore, the treatment of these cases should not be confined simply to the palpable and visible disease. Such visible and palpable disease should receive the most active treatment and sufficient to cause its destruction and disappearance.

4. Thorough radiation treatment will cause the disappearance of tumor tissue in some cases and, therefore, can be recommended when there is any reason for avoiding an operation.

5. In every case of cancer of the breast there should be an X-ray examination of the chest, and this should be repeated from time to time to detect any possible invasion of the mediastinum or lungs, sternum, or spine.

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SURGICAL DIATHERMY AND RADIOTHERAPY IN CANCER OF THE UTERUS[1]

By G. KOLISCHER, M.D., Ch...

THE modern treatment of uterine cancer may be divided into, first, an extensive regional cleanup at the operation of hysterectomy as advocated by Ries; second, radiotherapy which has received a new stimulus by the recent innovations in X-ray technique. It has become the practice of other operators to use the Ries extensive cleanup in performing vaginal hysterectomy.

Without entering into a discussion of statistics I want to present to you a few considerations which have forced themselves upon us and which originated from observations made while treating malignant tumors in other regions of the body. From my observations I am convinced that the best results have been obtained by combining radiotherapy with other therapeutic agents. Pre-eminent among these agents may be mentioned surgical diathermy—the electrocoagulation of pathological structures. The high frequency current is applied to the tumor to be destroyed either with two active electrodes or by the monopolar method. This is immediately followed by X-rays or the insertion of radium.

While I am not in a position to impress you by showing you a long list of statistics, still I can present an argument which I believe is strong enough to influence you in my favor.

I have never seen such marked and rapid improvement under any other treatment, including radium treatment, as we are able to secure under the combination therapy. I may add that in our cases only one séance was necessary to bring about the results reported.

Surgical diathermy is the devitalization of tissues by the heat produced through the resistance that the tissues offer to high frequency currents sent through them. Permit me a little digression for discussing the use of heat in operating on cancers of the uterus. You will remember that about 30 years ago Mackenrodt, dissatisfied with the results of vaginal hysterectomy, introduced his igni-extirpation of the carcinomatous uterus. He removed this organ by severing its connection with soldering irons. The results did not improve so he discarded this procedure and took up the Ries operation. Later his method was again used here in Illinois and great results have been claimed for it.

Upon the authority of Doyen the theory has been accepted that cancer cells are more susceptible to the destructive influence of heat than other cells. It was also claimed that cancer cells were killed remote from the area of cle... found that this igni-extirpation involved great dangers. Extensive burning around the uterus as in other parts of the body is apt to produce general intoxication, among the results of which fatal duodenal and stomachic ulcers must be mentioned.

Electrocoagulation eliminates these dangers by virtue of the desiccation of the tissues and the immediate sealing of the adjacent lymphatics. To use a simile, we find here the same differences as between moist and dry distillation. There are also technical advantages connected with the use of diathermy. Its penetration as to depth and width may be accurately gauged, and the entire operation proceeds without any interruptions, so necessary in the use of the actual cautery.

In the beginning of our work, we, of course, tried to carry the destruction by diathermy as far as possible before following it up with radiotherapy. Later on, first forced by the conditions extant and later on guided by experience collected mainly in bladder work, we intentionally reduced the extent of desiccation.

Let me explain that by reporting a very instructive case in point.

... concerned a woman, who was the carrier of an ... formed into a discolored crater. Both parametria were widely infiltrated, the uterus was immovable, the floor of the bladder was involved, as proved by urinary disturbances and the cystoscopic findings. The complete or exten... fatal. Therefore, in order to obtain a palliative result, we ... n of 100 milligrams of mesothorium in a gold filter, surprisingly satisfactory. The sloughing proceeded rapidly, bladder function normal again. At the present time, that ... somewhat contracted, the portio is represented by a little button, to which is attached as remnants of the ...

[1] ... before the Chicago Gynecological Society ...

Now as to the explanation of this success. The electrocoagulation alone could not have been responsible, because only a small part of the tumor was diathermized. It is not in harmony with our other experiences that the single application of the mesothorium alone could have produced this regression. The question arises: Which combination of conditions may be offered as the working cause?

Let us consider radiotherapy first.

The discussion of radiotherapy has become of late a little stagnant and has been confined practically to a reiteration of statements, that have always left a dissatisfied feeling regarding results.

This dissatisfaction is partially due to the fact that the deductions made were based on allegations dating from the initial stages of this discipline, and partially due to the fact, that as premises were proffered assertions supposed to be axiomatic, though they are by no means unassailable. One of these accepted principles is the belief in the direct destructive action of the therapeutic rays on cancer cells. I submit that just as many and just as sound arguments may be marshalled up in favor of this contention as against it.

If it were true that the therapeutic result is based on the direct destructive action, it necessarily would follow that in each instance of a malignant tumor, therapeutic rays would be bound to make an impression on the malignant tumor. Unfortunately, this is not true; in many instances the tumors are not changed at all. Then the argument was put forth that in malignant tumors certain changes occured after radiation, showing this destruction and the improvement of the cancer. If we analyze these points we will see that the majority of these changes occur anyway in malignant tumors, whether they are radiated or not. They are the usual regressive changes observed after a certain length of time in every malignant growth.

All radiologists agree on one point: that the therapeutic results are enhanced if the tumor is placed into a hyperæmic state. That means that the cells are better supplied with blood, that they are energized. It is hard to understand how a cell in this state should more easily succumb to any destructive element, whether by X-rays or radium.

Another point to be considered is this: In cases of lymphosarcoma, if such cases are amenable at all to treatment, it is sufficient to ray only one of the tumors and the others will disappear also. Consequently, it cannot be a direct destructive action. It is just as plausible to assume that under the influence of the rays certain materials are produced which will produce defensive ferments which in turn will act on the tumors.

Another experience is in favor of this conception; if you take the carrier of a cancer and radiate the tumor and while the patient is in the reaction take his or her blood and inject it into another individual suffering with carcinomatous cachexia the general condition will improve, and this improvement will last for some time. It is reasonable to assume that certain elements were produced in the donor which if injected in the second patient are antagonistic to the products of the decaying cancer cells that cause cachexia.

It will also occasionally occur that under the influence of rays a malignant tumor will begin to grow rapidly. This luxuriation can hardly be explained by the theory of direct destruction. It is more plausible to assume that in these instances the production of the stimulating ferments outstripped the formation of retarding ferments.

This ferment theory is supported by other instances. We all know for instance that localized tuberculosis is very favorably influenced by X-rays though the bactericidal action of X-rays is practically nil.

Now as to the influence of the diathermy. The effect of electrocoagulation on bodily structures has been very carefully studied by a number of observers and recently Dr. Corbus, by experiments on dogs, added to our information. We may distinguish three zones produced by diathermy: the first one, the zone of dessication or coagulation; the second, the sealing of the lymphatics; the third, a zone of reaction and aseptic inflammation. In this zone, according to the modern views, the cells are energized, vitalized. We find many round cells and lymphatics, all cells of high vitality. It is asserted that other cells also, especially the cells of the fibrous tissue which play such a prominent rôle in radiotherapy, are energized too. This is proven by the fact that these cells of the fibrous tissue will accept intravital stains which they ordinarily do not do. The cells return to their juvenile state. Now, if that is true there is no reason not to believe that the cancer cells still in their period of activity are energized in the same way as the normal tissue. It is possible to believe that these activated cancer cells under the influence of the rays will produce defensive ferments.

If this be true then we have to change our method of attacking cancer of the uterus. It means that we will not dare to remove the entire cancer but only the decayed and decaying cancer cells. These latter have lost the poten-

tiality of producing ferments. The virile cancer cell is the object of the ray. That is, by directing the therapeutic rays toward these energized cancer cells, we may accomplish a real chemotherapy of the uterine cancer.

I have only five cases of the above character to report, but by the results obtained I feel sufficiently encouraged to ask you to give this combined method a trial in inoperable cases of uterine cancer.

A SIMPLIFIED APPARATUS FOR THE TRANSFUSION OF BLOOD BY THE CITRATE METHOD

By WILLIAM H. BYFORD, M.D., Ch.
Assistant Surgeon, St. Luke's Hospital

THE technique of blood transfusion by the citrate method may be facilitated if care is taken with several details as follows:

1. The needle or cannula and the tube through which the blood is drawn should be of the same caliber. If the needle is smaller than the tube the result is a decreased rapidity of the blood flow in the tube with consequent tendency to clot in the tube before the citrate solution is reached.

2. Both tube and needle should be as large as is consistent with the vein to be punctured. This again reduces the liability of clotting, decreases the time spent in operating and so brings the injected blood closer to body temperature.

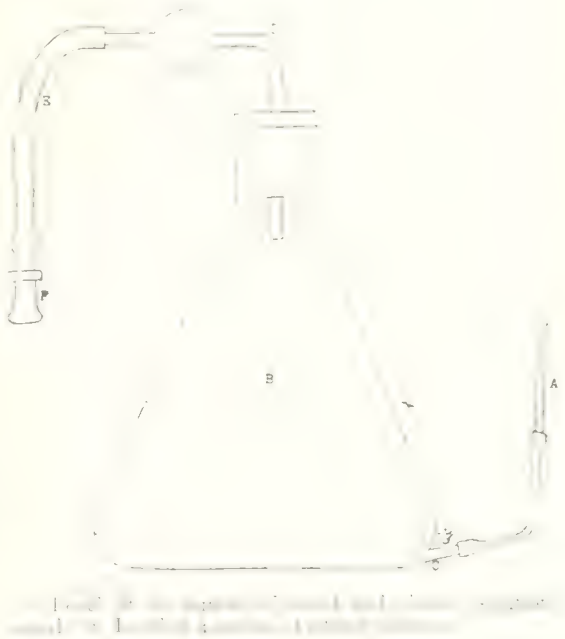
3. The inside of the needle and tube should be free from any irregularities which will slow up the flow or be the resting place for a clot. Ablemann's ointment may be used for this purpose. The smoothing and lubricating properties of this ointment are probably of more value than is its anticoagulant property.

4. The tube through which the blood is drawn should open below the level of the citrate solution. Otherwise a clot may form at the tip of the tube and either block it up or fall into the solution below.

5. The distance from the vein to the citrate solution should be as short as possible.

The apparatus shown in the accompanying illustration is designed to comply with these five points.

The needle *a* is No. 13 gauge with the syringe end filed off. A piece of heavy rubber tubing 4 inches long and of $\frac{3}{32}$ inch caliber connects it to the Erlenmeyer flask *b* at *c* which is a piece of glass tubing blown on at the lowest point of the flask. The tube *d* is of glass and has a bulb to be filled with cotton. *e* is ordinary rubber tubing and *f* a mouthpiece.



When the needle is inserted into the vein, negative pressure at *f* draws the blood directly into the citrate solution without its having been previously exposed to the air. The large needle delivers the blood at such velocity that agitation to mix the blood and citrate solution is scarcely necessary. After a sufficient quantity of blood has been withdrawn the needle is taken out and a few drops of citrate solution drawn through it to wash it free from blood. The needle is then inserted into the recipient's vein, the mouth-piece detached and an air pump such as is used for taking blood pressure, substituted. As the solution approaches the bottom of the flask, the flask is tipped so that *c* is always well submerged.

THE PRODUCTION OF TEMPORARY PARALYSES IN THE TREATMENT OF DIFFICULT CASES OF CONGENITAL DISLOCATION OF THE HIP JOINT

By GEORGE ROBERTSON, F.R.C.S. (Edin.), Dunfermline, Scotland

MOST of the patients affected with hip-joint dislocation are seen and treated at an early age. In the large majority of these, the usual bloodless reduction, followed by prolonged fixation, suffices to effect a cure.

A certain number of cases, however, one meets in the older girl or boy, and there some difficulty may be encountered in securing the necessary amount of muscular relaxation to allow easy reduction of the head of the femur, and the easy maintenance of the correct degree of flexion, abduction, and external rotation at the hip-joint.

Those of us, who have performed the "bloodless" operation, will, I think, admit that the difference in treatment in the case of the young child on the one hand, and that of the older girl or boy on the other, depends, to a very large extent, upon the state of the upper thigh muscles and chiefly upon that group innervated by the obturator nerve.

Many of the early accidents at operation and the unfortunate early complications were due to the damage inflicted upon the limb by the severe tug-of-war between the muscles of the manipulating surgeon and those of his young patient. Such excessive force is never necessary in treating cases under 5 years of age, but, from 5 to 7 years and over that age, much difficulty may be encountered.

To minimize this muscular difficulty, I recommend that the surgeon should, in the first part of the treatment, temporarily paralyze the great adductor group. This he may do by ligature pressure upon the trunk of the obturator nerve. Such paralyses will last for several months, during which the limb is retained in the fixed position. When the time has come for the plaster fixation to be completely removed, these muscles will have regained much of their power, and, under the usual methods of treatment, will soon recover, especially as the limb will now be used for locomotion.

To a surgeon familiar with the anatomy of the region, the exposure and temporary ligature of the obturator nerve trunk at the obturator foramen will offer no great difficulty. The incision may be made as for the treatment of a femoral hernia or for exposure of the internal circumflex artery. The pectineus muscle having been clearly exposed, it is divided across its fibers as it rests on the horizontal pubic ramus. Thus may the accessory obturator nerve, present in about 30 per cent of cases, be divided at the same time. The adductor brevis muscle is exposed, its upper border clearly defined and retracted downward; thus the dense fascia covering the obturator externus muscle is exposed. This is incised in a vertical direction corresponding to the outer margin of the pectineus muscle. Thus the anterior surface of the obturator externus muscle, with the posterior division of the obturator nerve piercing it, is seen. This branch, or, any other branch of the nerve carefully followed toward the obturator foramen, will guide the surgeon to the nerve trunk as it emerges from the obturator canal.

The muscles thus paralyzed are the gracilis adductor longus, the adductor brevis, occasionally the pectineus from the anterior division of the nerve and the obturator externus, the adductor magnus, and occasionally the adductor brevis from the posterior division. The fibers of the adductor magnus which arise from the tuberosity of the ischium and descend vertically to the adductor tubercle are supplied by the nerve to the semimembranosis. These are not affected by the ligature pressure on the obturator nerve trunk, but should be put out of action by division of the tendon at its insertion into the adductor tubercle of the femur. This can easily be done by a separate small incision at this point.

Medium pressure upon the nerve by direct ligation and maintained for 1½ to 2 hours will give a paralysis of 6 months' duration. By medium pressure is meant just that amount of pressure one would employ in ligating a medium blood vessel with a thin catgut, without breaking it. Before ligating the nerve, bearing in mind the sensory distribution to the skin and joints, hip and knee, it has been my practice to inject a few drops of a 1 per cent solution of novocaine, so that, say, a quarter of an inch of the nerve trunk may be infiltrated. This little procedure is very desirable.

Seeing that the wound will be sutured at the end of the little operation, a special method of applying the ligature to allow of its easy removal,

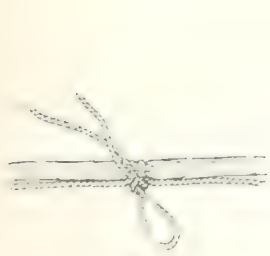


Fig. 1.

without disturbing the skin sutures, and reopening the wound, is desirable. This is the method I have devised and practiced and find quite satisfactory. The drawings will make the description clear.

I use thin twisted Chinese silk as follows: A length is taken and laid parallel to the nerve trunk, nerve and silk are ligated side by side by a second long piece of similar silk. The first half of the knot is tied in the usual way, the second half is fixed as a bow, with the bow-loop not longer than an inch. The two free ends of the ligature are brought out between two skin sutures, the two free ends of the "parallel to the nerve" piece of silk are also brought to the skin surface. Any little device, e.g. knotting the ligature ends while leaving the ends of the guide silk free, will serve to distinguish the one piece of silk from the other. To free the ligature, the bow-loop is undone by pulling on the running free end. The first half of the knot is still firm, and cannot be made to slip by further pulling. At this point, the free ends of the "parallel to the nerve" silk are pulled vertically toward the skin surface; this releases the first half of the knot of the ligating silk and thus all the silk is removed. These strands, four in number, leading from the depth of the wound to the surface, act, for the time being, as capillary drains.

After the operation wound has healed, likewise that at the knee where the adductor tendon was divided, the case may be left for, say, 2 weeks, until the scars are quite sound. Then the usual bloodless reduction and fixation of the hip joint may be performed with ease.

I am well aware of many [illegible] treatment of these cases, e.g. hour-glass constriction of the capsule, tension of the iliopsoas tendon, bony deformity of the upper end of the femur, etc., etc. With the exception of the bony deformity, I do not attach to these the importance they have had attached to them in the textbooks. Even the bony deformity difficulty is, I believe, often greater in the mind of the surgeon than it is in reality. An X-ray plate can exaggerate considerably if not too carefully taken. It is well to bear this in mind.

I consider this method of counteracting the adductor "pull," without either paralyzing these muscles permanently, as would be the case if the obturator nerve were divided, or without the bloody and more or less incomplete division of the muscle fibers themselves, the best method in certain difficult and rather late cases.

I have also used this same procedure of nerve ligation, so as to throw out of action troublesome muscular traction, causing much annoying difficulty in securing good alignment in the treatment of fractures of the long bones. It is not too much to hope for, that, in the near future, a properly applied pressure, either with or without a skin incision, upon a nerve trunk or nerve trunks, will rid our hospital wards of the multitude of heavy iron weights, sandbags, etc., to say nothing of the discomforts to the patient of skin plasters, glues, etc., used in conjunction with these, and which often stretch tissues, such as ligaments, to a harmful extent, without, I fear, gaining a complete victory over the more active muscular action.

A CLINICAL METHOD OF DETERMINING ADHESIONS BETWEEN THE STOMACH AND THE GALL TRACT

BY B. B. VINCENT LYON, A.B., M.D., PHILADELPHIA

Assistant in Medicine, Jefferson Medical College; Gastro-Intestinal Department, Jefferson Hospital; Attending Physician, McClintock Dispensary, Hospital, etc.

AN accurate clinical method of determining adhesions between the stomach and neighborhood viscera, but particularly useful for the detection of adhesions between the pyloroduodenal segments and the under surface of the liver or other parts of the gall tract, can be practised by making use of the transmission of the tuning fork note determined by auscultation. This I speak of, perhaps erroneously, as *tuning fork auscultation*. It is a method that I learned quite by accident 9 years ago and have been routinely making use of in all cases studied during this period, and now have hundreds of records of its use. Its reliability has been repeatedly checked, chiefly by X-ray in a large number of instances, by operative exploration, and, where possible, by postmortem inspection. So far as I am aware, it is a method that has not been heretofore described.

At the time I first accidentally realized the importance of this method I was examining a patient in a hospital out-patient service and, for purposes of demonstration, was making use of the various clinical methods of outlining the size, shape, and position of the stomach and was testing out the tuning fork, a "G sharp," for this purpose. With the bell of the stethescope in the usual position in the *left epigastrium* directly over the stomach, I had completed the mapping out of the left and lower borders of the stomach and then placed the stem of the tuning fork above the right costal margin directly over the liver and, to my surprise, I found the pure musical note was transmitted just as sharply and clearly through the liver as when the stem of the tuning fork was placed directly over the stomach. The obvious interpretation was that if this clear note could be transmitted through a solid organ such as the liver with the bell of the stethescope directly over a hollow viscus, the stomach, therefore some portions of these two organs must be in direct and intimate contact with one another, to a greater degree than the natural anatomic contact. Proceeding with the study of this case it was found to be one of cancer of the stomach with pyloric obstruction, and at operation it was found that the terminal portion of the lesser curvature and the pylorus and part of the duodenum were densely adherent to the under surface of the liver which was involved in metastases.

This was the starting point in the use of this test. I then proceeded to examine routinely each abdomen for this purpose. In *normal cases* one does not ever get the tuning fork note transferred constantly through the liver to the bell of the stethescope placed over the stomach. Occasionally one hears it clearly transmitted from the left half of the right costal margin in normal cases, but on repeating the examination from time to time this transmission will not be found constant. In other words, it may then be caused by peristaltic waves carrying the pylorus and duodenum up under the right costal margin and thus bringing them in more intimate contact temporarily with the gall bladder and under surface of the liver, especially if the stomach be distended with gas. Therefore, unless this transmitted note is heard easily and constantly on every examining occasion it should *not* be interpreted as adhesions.

In *pathological cases*, however, I have learned to differentiate the following types, which, as I have stated, have been confirmed by X-ray or by operation, as well as having certain other features appear in clinical study to support the suggestivity of adhesions involving this quadrant.

First, when the musical, tuning fork note is transmitted from the left half of the right costal margin and this phenomenon is found to be constant at each examination, I would expect to find rather slight formation of adhesions between pylorus or duodenum and the peritoneal coverings in the neighborhood of the gall ducts.

Second, when the note is transmitted from the costal margin in the region of the juncture of the ninth and tenth ribs, but is not transmitted through the liver, I would expect to find at operation that the adhesions are more likely to involve the gall bladder.

Third, when the musical note is transmitted by tuning fork along the length of the right costal margin from the epigastric border to the anterior axilliary line, and is very clear and distinct and always constant, I would expect to find rather older and denser adhesions attached to the looser neighborhood structures, gall ducts, gall bladder and gastrohepatic omentum.

Fourth, when the tuning fork note is constantly transmitted through the liver and heard above the right costal margin I would expect to find adhesions between the pylorus or duodenum and the under surface of the liver. The clear distinctness of the transmitted note and its wider distribution over a larger area of the liver suggests that the adhesions are denser in character or more widespread. All of these tuning fork transmissions of the gastric note will be enhanced if 3 or 4 ounces of air is injected into the stomach.

The most likely error which enters into these deductions arises from this anatomical fact, that in patients in whom the transverse colon occupies a normal position, the bell of the stethescope when placed in the mid-left epigastrium, will also be in topographical anatomical relationship with the transverse colon as well as with the stomach. Why, therefore, may not the transmitted tuning fork note be coming from the colon instead of the stomach? To differentiate this point it seems best to transfer the bell of the stethescope from the left epigastrium to a point just above and slightly lateral to the right iliac fossa so that by surface topography it is placed over the cæcum or ascending colon, at which point obviously the stomach can be ruled out. If then the tuning fork note is equally well transmitted from the costal margin or through the liver, and is found constant on repeated examinations, we might expect to find the adhesions between the hepatic flexure of the colon and the liver or gall tract quite as well as to infer that the adhesions involve the pylorus or the duodenum. It will be found that the note is transferred to the right iliac fossa much less frequently than to the left epigastrium. I believe this is consistent with surgical statistics that with inflammations of the gall tract adhesions are much more apt to form between the stomach and duodenum than between the gall tract and the colon.

It is necessary to emphasize [illegible] word of caution, in [illegible] When the stomach [illegible] the skin [illegible] at the same time [illegible] tension by pressing *toward* the bell of the stethescope and [illegible] in the latter position the skin is stretch[illegible] the stem of the tuning fork [illegible] stethescope and the transmitted [illegible] ducted superficially along the [illegible] It is very easy to prove [illegible] the bell of the stethescope anywhere [illegible] lower abdomen and placing the stem of the tuning fork over the liver in such a [illegible] the skin between the two points, in which case the tuning fork note will be transmitted [illegible] any point on the abdominal [illegible]

It is wise to interpret [illegible] test in a most restricted sense until [illegible] sufficient experience with it, in a large series of examinations, in order to develop [illegible] personal sense of security in its accuracy. It will be found a useful clinical procedure in the way of further suggesting adhesions of the upper right quadrant which involve the stomach, duodenum, or the hepatic flexure of the colon. The [illegible] of this simple clinical test being correct will be increased if the result of the X-ray examination suggests that the pyloric end of the stomach is pulled over to the right and upward, or there is found some distortion or flattening of the duodenal cap. Likewise, I have found that where this tuning fork test can be clinically considered positive for adhesions during the making of the physical examination, as we proceed to study the case by intubating the duodenum there frequently occurs some further confirmation of its reliability in that the gastroduodenal transit time of the duodenal tube is delayed above its average normal limit of 20 minutes.

EDITORIALS

SURGERY, GYNECOLOGY AND OBSTETRICS

FRANKLIN H. MARTIN, M.D.....Managing Editor
ALLEN B. KANAVEL, M.D.....Associate Editor

AUGUST, 1922

THE CONTROL OF CANCER

ONE of the great movements of modern medicine has been the dissemination of knowledge on matters of individual and public health. Editors of newspapers and other periodicals, recognizing the public demand for enlightenment on questions of health and disease, are effectively meeting this demand by directing attention to health departments conducted by well-informed physicians. In this manner valuable information has been made available to everyone, and newspapers and popular magazines have become influential factors in the rapid progress in this country toward better health. When, besides this better health propaganda, a campaign is directed against one controllable disease, its ravages should be materially diminished; this is borne out by the present status of tuberculosis in this country as compared with conditions 15 years ago. Fifteen years of war against tuberculosis by the National Tuberculosis Association have been chiefly responsible for the steady decrease in the number of deaths from tuberculosis in this country, and judging by these results, this decrease in the death rate may be expected to continue until it has been brought to its minimum.

The success of the National Tuberculosis Association in the control of tuberculosis and in increasing the length of life has led to similar organized efforts in the control of other diseases. Cancer, of course, offers a field of wide possibilities, because of the many established facts concerning it which are unknown to the public. For example, one of the most common misconceptions of cancer is that the knife spreads the disease. If the cures of cancer by early operation could be given the publicity that is given to failures to cure by late operation, this misconception would be quickly dispelled.

The desirability of more comprehensive and organized efforts to acquaint the public with the vital facts concerning cancer led to the formation of the American Society for the Control of Cancer. The Society, under the presidency of Dr. Charles A. Powers, of Denver, recently concentrated its activities in its first "Cancer Week." During this week every possible means was utilized to give nation-wide publicity to the facts concerning cancer. Short talks were given by physicians to more than two million people; moving pictures telling the dramatic story of the curability of cancer in its early stages and the certain fatality of the disease in its late stages were exhibited in all sections of the country. The article, "Cancer, a Message of Hope," by Dr. William W. Keen, was read in a great many churches on the Sunday of Cancer Week; street cars in some of the large cities were placarded with facts concerning cancer; articles on cancer appeared in many newspapers; special meetings of medical societies

were called for symposia on cancer; talks on cancer were given at public meetings held under the auspices of the American College of Surgeons; cancer clinics were held, and medical and surgical journals added their support to the campaign. Since the only immediate prospect of bringing about a decline in the death rate from cancer is through greater familiarity on the part of the public with the fact that in early diagnosis and treatment lies the one hope of cure, it is certain that such a campaign, particularly if followed up by continuous educational propaganda, as has been urged by the *Journal of the American Medical Association*, will save many persons from death by cancer.

In connection with the education of the public, the medical profession should be reminded constantly that, while the public must be taught that early diagnosis is essential to cure, it is just as essential that prompt and efficient treatment be instituted if permanent results are to be secured. Simmons and Channing, in a study of the records of patients in the Massachusetts General Hospital, have shown that to an initial delay of five and four-tenths months from the time the symptoms were first noticed to the time of the first consultation with a physician there was an added period of three months before correct advice was given. This incidence is not greater than that in other large clinics; in fact, similar studies, such as those of the Pennsylvania Commission, have shown it to be considerably higher. Patients, therefore, are only partially responsible for the appalling number of cases of advanced cancer observed in clinics at the present time, and the responsibilities of the medical profession should not be overlooked in the consideration of the causes for this condition and their correction.

Through the continuation of vigorous educational propaganda, therefore, a decline in the mortality rate from cancer will undoubtedly take place. The American Society for the Control of Cancer, having as its chief aim the circulation of information concerning cancer, deserves the encouragement and aid which comes from the interest and active support of the medical profession. Of equal importance work[illegible] profession to decrease the fatal period of delay between the time the patient seeks advice and the time proper treatment is advised and carried out. DONALD C. BALFOUR.

A CENTRAL BUREAU OF PATHOLOGICAL MATERIAL

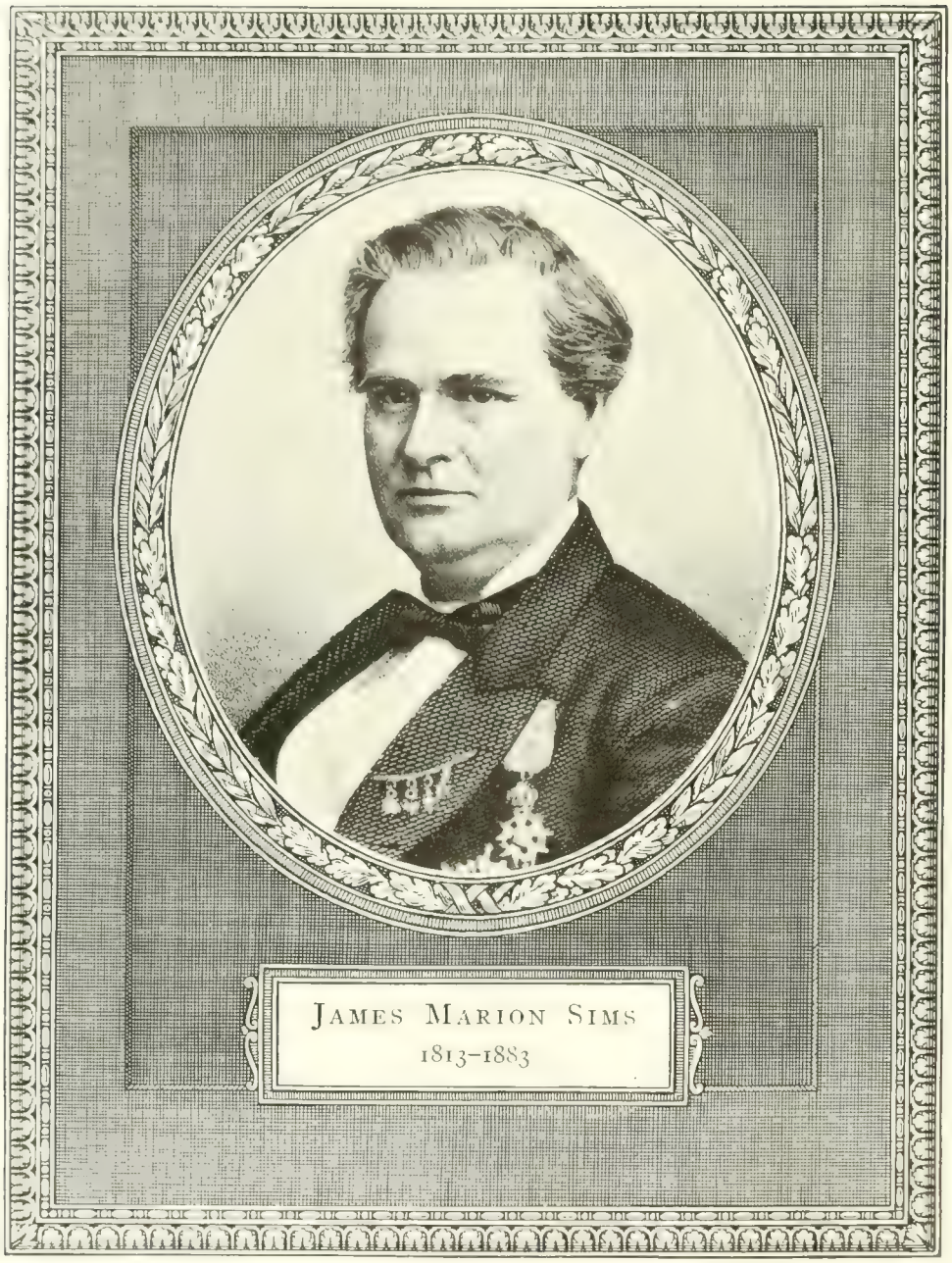
THROUGH the proposed College Library and Department of Literary Research, the American College of Surgeons contemplates meeting a long-felt and obvious need. Akin to this, however, is an even greater need, not limited to any branch of the profession but of interest to the scientific world. Its indications are relatively greater because no substitute is available, as is the case with respect to a library; it is universally of interest because its scope and results would definitely advance knowledge of diseases. Reference is made to a central bureau for the preservation of pathological material, especially histological sections, for record and study. The subject is here presented for the consideration of the fellows in the hope that there may be developed a sentiment that will lead to steps being taken to further the consummation of this project.

The idea was conceived during efforts to study the neoplasms and cysts of the spleen. It then became apparent to the writer that material was not available for this study; efforts to obtain material from reported cases met with little success. Until tissue from a considerable number of cases can be assembled and studied, a satisfactory classification of

sarcoma of the spleen cannot be made. To make possible such comparative histological studies, a system for the interchange of laboratory specimens should be established both at home and abroad through a central bureau. Only in this way can facts be expeditiously collected in regard to such unusual lesions. There are numerous other lesions which demand further study and classification before the last word on them can be said. Sections from such cases should be filed, indexed, and rendered available for study. Such a move would do much to further our knowledge of many types of malignant growths including bone sarcoma, to mention only one of the more immediate needs. Moreover, a call for desired material might well be issued for an investigator through the central bureau. The College would appear an appropriate place for such a bureau; the Surgeon General's Museum, as suggested by Elser, also offers a suitable medium for carrying out the project.

The question of the follow-up system pertains to this same consideration. It is disappointing that the late results of such cases as have been reported once cannot be obtained. A satisfactory follow-up system will do much to give the individual surgeon information about his own cases. But more than this is necessary; the late results of previously published cases should be recorded when such cases are of types about which relatively little is known and about which much information is desired. This deficiency could be corrected to a large extent by slight effort on the part of our leading surgical societies. The members should be encouraged to publish the outcome of previously reported cases in which interest pertains to the ultimate result. This particularly applies to malignant growths. Thus, an occasional successful case of resection of œsophagus for carcinoma has been reported. Such cases will be referred to for years; should they pass without record of the late results? Numerous cases of Gaucher's spleen have been reported as cures, yet the late results are rarely available.

Only the general indications have been presented; it is hoped that details may be worked out and an effective organization developed so that a central bureau for unusual histological sections may be established, and that recorders of unusual cases, especially "cures" of malignant growths be stimulated to report the ultimate results. EUGENE H. POOL.



JAMES MARION SIMS
1813–1883

MASTER SURGEONS OF AMERICA

JAMES MARION SIMS

IT IS difficult for the present generation to realize how great an influence Marion Sims exerted upon the surgery of the world. His fame was not sectional. Born in the South, he came to his fullness in New York and crowned his career in Europe by the highest recognition ever given an American surgeon.

A short review of Sims' interesting, all but romantic, life will justify his universal reputation and prove his greatness.

His birthplace was Lancaster County, South Carolina, where he first saw the light on January 25, 1813. The record shows that after attending school and academy he received a degree from his State College in 1832, that he took a year's course at the Charleston Medical School and that he was graduated in medicine at Jefferson Medical College, of Philadelphia, in 1835. Thus equipped he returned to his native place for practice, but within a few months he became discontented and the autumn of the same year found him in Mt. Meigs, Alabama. Here he settled down to the life of an average country doctor. In his autobiography (*The Story of My Life*, 1884) he portrays feelingly the trials of the rural practitioner, and emphasizes, with some show of impatience the discouragements and failures attendant upon such desultory work. Certainly Sims was not a success as a general family physician. He was restless, ambitious, fired with zeal for doing and finding things, and not satisfied with the beaten track of routine practice. While there are many able men who perform the most useful service in such affairs, Sims was not cut in that mold. He was yet to find his work.

When, following a short engagement in an expedition against the Creek Indians, he moved into Montgomery, Alabama, at the end of the year 1840, he struck his stride. His indomitable energy seized the opportunity to obtain a large surgical practice, and he was soon forced to build a private hospital in a corner of his lot for the accommodation of patients, whose care eventually made him famous. It was in 1849 that he announced his first cured cases of vesicovaginal fistula. The events leading up to this present many features of dramatic interest. From the time of Sims' arrival in Montgomery he performed all sorts of operations in general surgery, such as those times permitted—amputations, harelip and cleft-palate repair, certain eye operations, tenotomies for club foot, and removal of the jaw. The most difficult cases were brought to him. Among the most

interesting ones were the vesicovaginal fistulæ, frequent at that time as the result of poor obstetrics, and considered practically incurable. Two apparently insignificant occurrences brought about the first successful result in the repair of these fistulæ after many failures: One was the observation that in the knee-chest position air will rush in and balloon the vagina as soon as the vulvar orifice is opened, especially when a bent pewter spoon (the first Sims' speculum) was used to retract the perineum; the other was the accidental sight of a spiral brass wire discovered while walking along the street, and suggesting the use of a fine silver wire to close the denuded edges of the fistula. The bent spoon exposed the opening and the silver wire sutures held tight without sloughing—thus were removed two previously insuperable difficulties in the way of relieving these suffering women.

This operation now is so easily performed and the results so uniformly fortunate that we can hardly conceive of the conditions under which Sims worked. Month after month for 4 years he labored to gain access to the site of operation, finally using his speculum in the latero-prone position (since named after him); time after time witnessing the breaking down of the wounds closed with silk sutures; persisting until he was rewarded with success in the case of a colored woman after thirteen successive operations.

Small wonder that under the terrific strain of work, accompanied by anxiety and worry, the body, never very strong, broke down. He was compelled to give up his practice for a time. In 1853, 4 years after his wonderful contribution was given to the world, he resolved to locate in the city of New York, where he might command a larger audience and a wider opportunity for professional service. The usual opposition met by a newcomer was his lot, but after a few years his triumph was complete, resulting as his chief vindication in the founding of the Woman's Hospital, of which Sims was the creator and which now stands as the highest type of this class of institution, a lasting memorial to him. His noble figure in bronze stands in Bryant Park.

Eight years in New York sufficed to spur Marion Sims onward, seeking other worlds to conquer. In 1861, just as the Civil War in this country was beginning, Sims sailed for Paris and asked the eminent surgeons of that city (then the surgical center of the world) for patients that he might demonstrate his method of cure in vesicovaginal fistula. The first of the surgeons he sought was Velpeau, then at the height of his fame, and a pleasing account of the interview is given by E. Souchon, of New Orleans, who was then a medical student in the French capital. Doubt, haughtiness, and cold demeanor marked the Parisian surgeon's manner toward the American claimant, but, with Souchon playing the part of interpreter, after several days a patient was found and operated on by Sims in the presence of masters like Velpeau, Nélaton, Ricord, and Malgaigne and of medical students in large numbers. The result was a perfect cure. Then case after case, both hospital

and private patients, many in abundance and with the exception of two who were near dying under chloroform, nothing happened to mar the continued round of successful operations, most of which were done without any anæsthetic, and all of which resulted in cures. His fame and fortune were made.

From Paris he crossed to London and then back to Germany and Austria and all the European capitals. Later he settled in Paris with his family and lived there for the most part. A few months of each year he spent in New York. On one of these visits home in 1883 he passed away quietly and painlessly in his bed.

Though Marion Sims deservedly has been called the "father of gynecology," for he was the first to devise proper instruments and to invent means of operating successfully in the genital tract of woman, yet he was more than that. He was a competent surgeon in other branches of the art, and many principles established by him have done much to bring surgical science to its present position. He was not the first to suture intestinal wounds, but the rules he laid down in 1881, two years before his death, placed the management of gunshot injuries of the abdomen on the firm basis which it occupies today. Briefly, his rules were that the external wound should be enlarged to ascertain the extent of injuries inflicted; that the wounded intestine should be sutured and bleeding vessels ligated; that diligent search should be made for extravasated matter, fæcal or bloody, before closing the cavity; that the surgeon must judge whether to drain or not. While Bobbs, of Indianapolis, preceded Sims by a few months in the removal of gall stones, thus gaining priority, Sims performed the operation independently and is undoubtedly responsible for its adoption as a definite procedure.

No surgeon has achieved so wide distinction and so universal acclaim as Marion Sims. His name and fame were known throughout the civilized world. He was heralded in all the countries of Europe and received decorations from the governments of France, Portugal, Spain, Belgium, and Italy. Through him American surgery was carried to the four corners of the earth, his first and great discovery bringing joy to thousands of wretched women everywhere.

The life and work of Sims should give heart to the young surgeon. By patience, sheer industry and a tenacious purpose he rose from an obscure existence in a remote country district to be the most renowned figure in the surgical profession, loved and honored at home and abroad. To take infinite pains; to develop the capacity for hard work; to keep everlastingly at it; to do one thing well; not merely to win success, but to deserve it—these are attributes of genius. And James Marion Sims was the surgical genius of his age.

Hunter A. Royster.

TRANSACTIONS OF SOCIETIES

CHICAGO GYNECOLOGICAL SOCIETY

REGULAR MEETING HELD JANUARY 20, 1922, W. C. DANFORTH, PRESIDING.

MELANOSARCOMA OF OVARY

DR. BERTHA VAN HOOSEN: I have here a specimen of a melanosarcoma of the ovary. The patient was a woman of 40, who had had one child 2 years ago. The tumor occupied the entire abdominal cavity and the patient was distended more than a full-term pregnancy. The organs of respiration were seriously interfered with. The tumor was first noticed 7 years ago and it grew rapidly in the last year. On removing the tumor 32 ounces of fluid were removed and as much more was sopped up with sponges.

The tumor consisted of four globular masses, two of which were made up of dermoid masses while the other two contained growth that looked malignant. The pathological report was as follows:

"Sections show chiefly necrotic tissue. There are small islands of sarcoma tissue, however. The pigment cells are polymorphous, some round and some spindle-shaped. The amount of pigment varies in different parts of the tissue. Some of the cells are deeply pigmented with dark brown granules, others with no, or very little, pigment. The stroma is very scanty with a little tendency to form an alveolar arrangement of the sarcoma cells."

I never had such a case before and asked Dr. LeCount if, in his experience, such cases were very common. He said that unless serial sections were made of the ovary it would be difficult to persuade gynecologists that it was melanosarcoma. There is a section of the growth under the microscope.

LEUCOCYTOSIS FOLLOWING GYNECOLOGICAL OPERATIONS

DR. R. A. SCOTT read a paper on leucocytosis, following gynecological operations. (See p. 181.)

DISCUSSION

DR. THOMPSON: Dr. Scott opens an interesting question for debate as to when a laparotomy is a clean base and when not. This particularly in reference to cysterectomies for fibroids. My opinion is that a fibroid cannot always be said to be a clean case, but this is not so of ordinary ovarian cysts. We regard those as clean cases and his cases show very slight leucocytosis after removal of ovarian cysts. But I believe a blood count to obtain hidden infection. The patient may show a low leucocyte count before operation and after operation a very high one, owing to the fact that infectious area of which you have not been aware, and of which there has been no previous history has been disturbed.

DR. JOSEPH L. BAER: In the course of his paper Dr. Scott comments on blood counts taken in extra-uterine pregnancy, speaks of the normal increased white count in normal pregnancy, and then compares that with the white counts of extra-uterine pregnancy. In 1915 I ran a series of white counts, differentials and Arneth studies on women at the end of pregnancy, in labor, and in the puerperium, and in the literature at that time and in my own experience there was no leucocytosis of normal pregnancy. It is only in the last 10 days before labor that the pregnant woman shows even the slightest increase in the leucocytes. That seemed at that time not only my own experience but the general consensus. Has the doctor cases or something more recent in the literature to justify his contention for a normal leucocytosis in pregnancy?

DR. R. A. SCOTT (closing the discussion): In answer to Dr. Baer's question I might say that while an interne at the Evanston Hospital we ran through 50 cases on which we made counts on women coming in during labor. They ran as high as 12,000 and all had a slight rise in white blood cells as they came in in labor. No counts were made previous to that time. There is a paper by White in 1900, in which he reports several hundred cases, and in which he refers to a slight leucocytosis during the last few months of pregnancy.

In regard to an infected fibroid, I think the leucocytosis following operation was due to an infection arising in the cervix. The first day after operation in those cases it is generally 14,000 to 17,000 and in one case in which the pathologist reported a degenerated fibroid the count was as high as 29,000. I may be wrong in thinking that the leucocytosis was the result of infection arising from the cervical stump after amputation of the fundus.

SURGICAL DIATHERMY AND RADIOTHERAPY IN CARCINOMA OF THE UTERUS

DR. GUSTAV KOLISCHER read a paper on surgical diathermy and radiotherapy in carcinoma of the uterus. (See p. 227.)

DISCUSSION

Dr. James F. Percy (Galesburg, Ill.): I am exceedingly interested in this discussion that Dr Kolischer has given us and I am in a position to agree most thoroughly with many things that he has said. Particularly one statement he made among the last, and that was that we have to come to a time when we do not aim to remove cancer. I have never urged the removal of cancer. I have always advocated heat and with the cautery rather than diathermy which failed in my hands. I am gratified to come here tonight and to know that you are talking about heat, even though it is produced by the diathermic current. It has simply needed someone to correlate the experiences of the different men and in that way give all of us the benefit of what has been done before.

Dr. B. C. Corbus: In looking up the literature during our experimental work on dogs we have found that Rhodenburg and Prime, experimenting on cancer tissue in rats found that mild degrees of heat destroyed the virulence of cancer tissue. The tissue was heated over an ordinary water bath.

I think the time is coming when the knife will not be used in the treatment of any cancer. I think that time has arrived in the treatment of cancer of the bladder. I have been using diathermy, and my experience is limited to that method. I think, as Dr. Bloodgood has said: "If we have a knowledge of the local condition and an early diagnosis" and use some form of heat therapy, our results will surely be better than they have been with the knife. In the last year you could hardly pick up any journal on urology in which you did not find a description of some new method of removal of bladder tumors by excision.

One thing we do which I think is a mistake, and that is to use indiscriminately the method of excising cancer tissue for diagnosis. Everyone realizes that metastasis is the one fatal thing in cancer, and I think every other method should be used in the attempt to make the diagnosis without taking out a piece of tissue. If tissue is taken it should be removed with the cautery.

Dr. George L. Davenport: I wish to add another case to those Dr. Kolischer has reported, an extensive carcinoma of the cervix of a type everyone has seen. The ulceration was so great that episiotomy had to be done to get at the cervix, it was hung up so high. The woman never had had any children. Diathermy was applied. In using diathermy the method of application and the method of control, it seems to me, should be very accurate in contradistinction to the actual cautery or hot iron. This case was treated a year ago and several weeks ago the patient was pronounced clinically cured. The time is very short and I do not hope to get a permanent beneficial effect from this. Two years previously the patient had had a laparotomy and had a large keloid on her abdomen, but treatment with radium and diathermy combined caused the keloid to disappear. The scar was very long and the entire thing disappeared.

I believe diathermy has its place just as well as the cautery. Heat is heat no matter how applied and I think diathermy is indicated in certain places, and I believe the [illegible]

Dr. Henry Schmitz: I agree with Dr. Kolischer as to the feasibility of combining the cautery with diathermy in cancers other than uterine. In the cancers of the mouth the [illegible] and radiation are much better than with radiotherapy or diathermy alone. It appears to me that the results of [illegible] carcinoma differ entirely from those in any other part of the body. This observation may be explained in the following manner. [illegible] and do not remove the tumor and it remains exposed to the continued physiological actions of the body, as in the mouth and in the bladder, we observe that instead of getting permanent results a recurrence and ultimate death follow. The sexual apparatus of the female is entirely destroyed by radiation and therefore not any more exposed to physiological activity. We might as well concede that the pelvic organs have been removed *in toto* by radiation.

The treatment of carcinoma by radiation is still in its infancy. As soon as means are found which will enable us to determine the intensity of radiations, I am sure results will be much better than they have been in the past.

Dr. Emil Ries: I am not a radiologist. I have constantly been surgically active in the treatment carcinoma of the uterus and I wish the gentlemen who were so strong on radiology tonight would have come forward with a few results like those we have who do surgery. If you have inoperable carcinomata, irremovable carcinomata, carcinomata with extensive metastases, nobody wants to do surgery, and if these patients [illegible] careful, safe and pleasant way with radium or any other ray, it will be a great advance. But if I am considering my own cases of this category, what do I find has become of them? They are dead. Dr. Kolischer gave a series of statistics some years ago of cases treated with X-ray, and they were all dead except one. He stated that we did not know or understand the treatment sufficiently, that we did not know the proper dosage, and so on. How much better are we off today. If we can cure these cases today, we are all delighted. It is no fun to operate—it is hard work. Nobody wishes to kill his patient. No one is more [illegible] than I. If I can be shown that [illegible] be cured by radiation, I shall be most glad to stop operating on these cases. But [illegible] of the cures? If anybody can talk with figures as men like Werthoim and Kronig and some [illegible] men have done, and show their cases, and show [illegible] specimens and show the results and [illegible] an extent to which they were never known before, then it takes more than mere theory to overthrow [illegible]

[illegible] why is it that a woman was [illegible] on whom I operated 21 [illegible] ago, the uterus which was so extensive that it filled my hand? So extensive that the lymph glands which I dissected out contained [illegible] cancer as big as the end of my thumb. [illegible] removed all of them as extensively as I [illegible] Why is it that that woman is living [illegible] it is so hard to remove all of the growth? She is not the only one; I have patients living after cancer operations all the way up to 22 years

Dr. Noble T. Goodspeed: In regard to removing a piece of tissue for examination and diagnosis, personally I have never seen any harm come from removing a piece of the cervix for diagnosis. I think no one should operate for removal of a cancer of the cervix or of the uterus unless they have previously made microscopic examination. Cases reported without such examination do not mean anything for the treatment used. You should know you have a carcinoma of the cervix before you start to operate. If you want to get an early carcinoma of the cervix you have to take a piece early when you first see a slight erosion in the cervix. I recently had a case in which I removed a small polyp and Dr. Zeit could not find any evidence of carcinoma in the uterus after operation. One of the big things in the treatment is to get the case early and you can do this only by taking a piece out or doing a curettement and making a microscopic examination.

Dr. Rudolph W. Holmes: I have always felt that my interest in medical work has centered around the conservation of life, obstetrics, rather than in that field of cancer which is the harbinger of death. I would not decry in any way the work that Dr. Kolischer is doing along with the host of others who have shown, and are showing, an avid interest in attempting to relieve suffering and to find the cure for cancer, for it is only by the work of these men that eventually will come the positive cure for malignant growths. The one great thing in the treatment of cancer today is based upon one fundamental fact, as I see it, and that is that the unfortunate patient is robbed of the assurance of certain death and given the happy thought of the uncertainty of life. I have been long enough in the practice of medicine to recall the days of escharotics in the treatment of cancer, and the enthusiasm with which they were applied. I was present the evening when calcium carbide was lauded before this society as a certain cure for cancer. Dr. Ries was present and will recall with what enthusiasm the essayist described the miraculous cures, and pictured the noxious emanations which bubbled forth when the carbide was applied. Dr. Etheridge did not know that he very possibly was the discoverer of acetylene gas. The nature of my practice is such that I may express merely an academic interest in the subject, but I have endeavored to read the vital papers on the matter of the cure of cancer, and therefore, have a vital interest in the academic discussion.

It is often reiterated that cancer is greatly increasing as a cause of death. I have yet to be convinced that such is so—no vital statistics can prove it, for figures, as compiled in previous decades are not comparable to those of the present, and do not take cognizance of the fact of a greater degree of diagnostic precision now over former periods.

Another thing: not many yet has shown that there is a reliable, definite, index of malignancy. Until that index is proven our knowledge of cures possible are uncertain and unreliable.

The near future will prove that X-ray, radium, cautery, whether actual, electric, will be found not the solution of the problem for the cure of cancer. The *early* eradication, on suspicion, of a growth, at present is the nearest to reach a promise of permanent cure, and yet surgery, in general, is not the great solution. The workers of the present will lay the foundation for the discovery of the cause of cancer, and with the recognition of the cause will come the positive and permanent cure.

Dr. N. Sproat Heaney: I do not wish to discuss the paper, but when I hear about the deleterious effect of the removal of tissue for diagnosis, when this diagnostic procedure is immediately followed by operation, if it is an operable case, I wonder how it has ever been demonstrated that such a procedure is detrimental to the patient. It has been repeated so often that I would like to know how it has been demonstrated that it is so detrimental.

Dr. E. J. Doering: I have been very much interested in this discussion, but personally, feel decidedly pessimistic. All cases of carcinoma observed by me in a practice of over 40 years—many operated on very early, some late, some not at all—all died within 2 years, with the exception of one patient who lived 5 years. All methods of treatment current, and all kinds of operations were tried. I studied radium treatment with Doctors Dominici and Degrais in Paris about the year 1910, and observed many cases, including some of my own, but these all died within the usual time limit of 2 years. So I regret to say that I have not seen a single case of carcinoma operated on or treated by any method known, early or late, that did not succumb. This is simply my own experience; others have had far better results, although I must frankly confess I sometimes doubt the diagnosis.

Dr. Gustav Kolischer (closing the discussion): It is hard to answer the brilliant speech of Dr. Ries, but I would like to put down some basic facts. Some years ago some professional statisticians went to work to analyze the medical statistics, and they proved to their satisfaction and to mine, that our medical statistics are not worth anything at all. One man in Switzerland sent out a questionnaire to about 100 clinics in Europe and took their figures, and after analyzing them proved that the patients who were not operated on for cancer of the uterus are better off than those who are operated on. I do not doubt for a minute

Dr. Ries' clinical statistics. He reported a woman upon whom he operated [illegible] he proved carcinoma of [illegible] microscopical examination. I cannot make myself believe that it is technically possible to remove all of glands that it is technically possible to remove all of the carcinomatous tissue. It is more probable that some such tissue is left behind. What became of that? There was no relapse. Consequently, there must be some other curative agent that killed those cells.

Dr. Ries wants to see cases. Very good but it is not always easy to bring those cases. Some time ago I had the pleasure of demonstrating to Dr. Baer a case of inoperable cancer of the uterus, microscopically identified. This woman is in perfect condition. Now if only a few cases of inoperable cancer are kept well from 4 to 5 years, something is accomplished and I am sure we do not accomplish it by simply talking against it.

Dr. Ries said he read about remarks until he was black in the face and then knew nothing about it, but it is possible the fault lies more with Dr. Ries than with these publications.

As to the use of surgery, we all are under the impression of our teaching. For many years we were taught that cancer should be totally removed, but is not every removal a confession of defeat? We cut because we cannot cure. If we had to cut out gummata we could not cure syphilis, but we do not need to do this because our syphilis therapy is developed. If we believed absolutely in medical authority there would not be much advance. You will find, every one of you, that some early cancers, attacked early by the so-called radical operation relapse after a while. One of the most evident proofs of this fact is this: if a so-called radical operation is performed in cancer there are supposed [illegible] Go into any X-ray [illegible] any radium laboratory and you will see the results of radical operations on cancer. If they [illegible] devils come from? On the other hand, I remember [illegible] did not relapse for years and years after we simply [illegible] unoperated upon [illegible], after raying for a long time, [illegible] tive effect. The [illegible] for instance, who is one of the best operators, [illegible] in [illegible] patients. It is [illegible] X-rays and radium in former years was not correct. I admit that, but we find that the results improve by [illegible] cancer [illegible] that is hard to sustain. We know that men who work in aniline factories and their neighborhood develop a great many cancers of the bladder. Two factors combine for production of the cancer. The local disposition of the vesical tissue and the exciting influence of the tar products. Why should not their results combine? Cancer is not a local disease. It is due to [illegible] some local [illegible]

Without going into [illegible] be brought forth I would like to say this: We all [illegible] disappeared without an operation. Consequently, some materials must have been developed in the body which destroyed them. So why should not materials be artificially produced that make life so miserable for the cancer cells that they lie down and die instead of the person [illegible]

CHICAGO SURGICAL SOCIETY

Regular Meeting Held March 3, 1922, Dr. Dean D. Lewis, Presiding

TUBERCULOSIS OF THE TONGUE

Dr. Fred C. A. Besley. I desire to report a case of tuberculosis of the tongue, and the reason for reporting is obvious. Cases of tuberculosis of the tongue are relatively rare. In this case the tuberculosis occurred on the tip of the tongue in a man 52 years of age. Four years before he came under my observation he had the influenza. Following the influenza he had protracted cough, night sweats, and the characteristic symptoms of a tuberculosis. Six months before he came under observation he noticed on the tip of the tongue a pimple, as he described it. This rapidly grew larger, became painful, so that he could no longer eat with comfort. He complained of salivation and inability to eat. He lost 40 pounds in weight during the 6 months before he came under observation. He had a severe hæmoptysis. Examination of the tongue disclosed a hard, indurated mass at the left of the median line, directly at the tip. There had been no rough teeth or irregularities in the mouth that caused any abrasion. Whether this was a direct infection or a hæmatogenous affair, I do not know. He had, when he came under observation, active tuberculosis of the lung, with many tubercle bacilli in the sputum. A small section had been taken out before I saw him, and the diagnosis of carcinoma had been made at the dispensary. The growth was removed through a wedge-shaped incision, and the patient made a prompt recovery. The patient has gained the 40 pounds in weight he had lost previous to the operation.

Inasmuch as a diagnosis was made of carcinoma of the tongue, I have wondered whether we are not apt to overlook tuberculous lesions in the tongue.

Dr. Jacob Frank read a paper entitled "Thrombosis of the Mesenteric Artery."

SOME NEW OBSERVATIONS REGARDING CONTROL OF THE THYROID GLAND

Dr. W. B. Cannon, Boston, Massachusetts, discussed "some new observations regarding control of the thyroid gland, an abstract of which follows.

Histologists have described non-medullated nerve fibers reaching to the cells of the thyroid gland. Anatomists find that fibers going to the thyroid gland arise in cervical sympathetic ganglia. It had been shown that severance of its cervical sympathetic nerves causes atrophy of the thyroid and that stimulation of these nerves causes a diminished iodine content of the gland. In 1916, in co-operation with Cattell, I pointed out that if the thyroid gland and neighboring indifferent tissue are connected through a galvanometer, stimulation of the cervical sympathetic cord evokes an electrical action current after a latent period varying between 5 and 7 seconds—an effect which persists after the superior and the recurrent laryngeal nerves are severed. This does not occur if the main trunk of the vagus is stimulated, or if pilocarpin, which is an excitor of vagus endings, is injected. The effect cannot be attributed to the shutting off of the blood supply by vasoconstriction, for total anæmia produced by clamping the carotids for a period equal to that of sympathetic stimulation produces no noteworthy electrical changes in the gland. From this evidence the conclusion was drawn that the nerve fibers distributed to the thyroid cells belong to the sympathetic and not to the cranial division of the autonomic system, and since their effects are not indirect through alterations of blood supply, they are indeed true secretory nerves.

The electrical evidence given above was confirmed by the experiments of R. L. Levy in the Harvard Physiological Laboratory in 1916. He made use of the fact that, if thyroid substance is introduced into the blood stream, standard doses of adrenalin injected intravenously will cause a greater rise of blood pressure than they caused previous to the thyroid dosage. He found that after stimulation of the cervical sympathetic there was, indeed, a greater effectiveness of the adrenalin injections, amounting in some instances to as much as 200 to 300 per cent.

Since adrenalin will mimic the action of sympathetic impulses it was to be expected that adrenalin itself would stimulate the thyroid. This Levy found to be the case. Stimulating doses of adrenalin caused a greater effectiveness of the repeated standard doses (which were very small). If the thyroid glands had previously been removed, however, both cervical sympathetic stimulation and adrenalin injections failed to produce an increase of the response to the standard doses.

Levy proved that stimulation of the cervical sympathetic caused the thyroid to secrete promptly. Removal of the thyroid gland immediately after stimulation was followed by an increase of the efficacy of the standard doses similar to that observed when the glands were left in the animal throughout the course of the experiment.

The method used by Levy involved destruction of the upper part of the central nervous system. This procedure did not permit tests to be made on the effects of such stimulation as would in the conscious animal be accompanied by sensations of pain, nor upon the influence of asphyxia. Both painful stimulation and asphyxia are known to cause sympathetic discharges. It was desirable to have another method, therefore, which would permit such tests as these to be made.

In 1920, in co-operation with P. E. Smith, I made use of the denervated heart as an indicator of thyroid activity. In this preparation both the stellate ganglia, and the vagus nerves are disconnected from the heart, so that, though performing its proper function as a pump for the circulating blood, it is no longer subject to nervous stimulation. Anything that alters its rate must do so, therefore, by way of the blood stream. If the temperature of the animal is kept uniform and the ether anæsthesia is likewise maintained at a fairly uniform level, the heart rate does not vary more than a few beats a minute through several hours of observation.

With the denervated heart thus prepared we found that gentle massage of the thyroid gland for 2 or3 minutes would cause an increased rate amounting in some instances to 33 per cent over the basal rate. The development of the maximal increase was usually slow, requiring from 30 to 60 minutes, and passing off in a similarly slow manner. Massage of another gland, for example the submaxillary, did not cause this effect, and massage of the thyroid would cause it even though the adrenal glands had previously been removed.

We found that stimulation of the cervical sympathetic trunk would induce a similar increase of the rate of the denervated heart, but that this did not occur if the thyroid gland had previously been removed on the stimulated side.

In order to make clear the effects of reflex stimulation, it is necessary, first, to call attention to the fact that stimulation of an afferent nerve will cause a sharp rise and fall of the rate of the denervated heart. This does not occur if the adrenal glands have previously been removed and the nerves of the liver have been severed. Stimulation of the hepatic nerves will cause a brief acceleration of the heart, especially in animals that have been fed meat. The temporary rise and fall is therefore due to adrenal and hepatic secretion.

Reflex stimulation of the sciatic or brachial nerve, such as would cause sympathetic impulses to be discharged, had the same effect on thyroid secretion as direct stimulation of the cervical trunk, but with the addition that there was a primary acceleration of the heart due to adrenal and hepatic discharge. This was followed by the same, slowly developing thyroid effect. Asphyxia, likewise, had the same influence. On the other hand, if the thyroid glands had been previously removed, sensory stimulation and asphyxia induced only the increased rate due to adrenal discharge.

The foregoing evidence—electrical, vascular and cardiac—is harmonious in testifying to a control of the thyroid through the sympathetic strands in the neck. By connecting the phrenic nerve with the cervical sympathetic and waiting until the phrenic fibers have grown out to the distribution of the sympathetic fibers we have been able in a certain percentage of cases to produce many of the phenomena of hyperthyroidism. When this operation is done there would be discharged to the distribution of the cervical sympathetic, nervous impulses with every respiration. Thus nerve filaments affecting the thyroid would be continuously excited by normal impulses from the central nervous system. In animals which showed indications of hyperthyroidism there was an increased heart rate running up from the normal, which in the cat is approximately 150 beats per min[illegible] beats per minute. The character of the animal changed from that of a quiet, affectionate, domestic pet to that of a furtive creature running away from anyone entering the room. There were loose movements of the bowels without evidence of fermentative change. The skin of the neck and head became thickened in spots, and there were patches of alopecia. The most characteristic alteration, ho[illegible] in metabolism. In one of the animals the increase of rate was 125 per cent. Removal of the thyroid gland on the operat[illegible] restored an animal in which the metabolism had been greatly increased to a rate which was within the normal range of variation.

It is not to be supposed that the foregoing experiments tell the whole story regarding the disease, exophthalmic goiter. It seems clear, however, that the nervous element is an important one, and since the [illegible] organization of the individual which is brought into action in times of great emotional stress, the experiments above described indicate that the thyroid gland may be seriously disturbed, and through it the body itself may be markedly affected, by great [illegible]

DISCUSSION

Dr. Joseph L. Miller: I would like to ask Dr. Cannon if he knows what this substance is in the liver that causes an increase in the pulse rate, and why [illegible] he has described, while the fasting animal does not do so.

I would like to know also, when the thyroid is [illegible] increase in the pulse rate, whether there is anything [illegible] hyperthyroidism in man. Also in fatal cases of hyperthyroidism in man, whether there is an enlargement of the suprarenals like there is in the animals.

I think his views fit in very well, indeed, with what we see clinically in mild cases of hyperthyroidism, that group of cases which is very extensive, and frequently not recognized, in which the patient has symptoms of hyperthyroidism that are only intermittent, only when excited, or when angered. These people I have observed when quiet show a normal pulse rate, but the minute they are excited [illegible] definite tremor. When the basal metabolism is taken on this type of case when quiet it may be normal, but this does not by any means exclude a

marked hyperthyroidism when the patient is excited, and in this group of cases if we are going to get [illegible] basal metabolism it must be taken when the patient shows symptoms, and not [illegible] when the patient is free from symptoms. We have had several cases of this type where the basal metabolism rate when at rest was normal, and yet under the X-ray they showed such marked improvement we felt quite convinced our clinical diagnosis was the correct one, and I am a firm believer that the diagnosis of hyperthyroidism is a clinical one, but that the degree of intoxication is a laboratory one.

Dr. Dean D. Lewis: With reference to the histological changes in these thyroid cases, I would like to ask Dr. Cannon how he accounts for the infrequency with which exophthalmos develops in the secondary goiters and the toxic non-hyperplastic goiters.

Dr. Cannon (Closing): The question regarding the relation of a meat diet to the effect of hepatic stimulation on the denervated heart is an interesting one. The only observations reported in the literature that might be related to it were made by Berg in 1914. He found in liver cells very minute irregular masses which stained with Millon's reagent and which represented, therefore, protein material. Starvation caused these masses to disappear. If the starved animals were fed carbohydrate or fat the masses did not reappear, but they were seen again if the animals were fed meat or amino-acids. These observations were confirmed by Stuebel in 1920, who observed further that adrenalin given subcutaneously caused the masses to disappear. Since adrenalin mimics the action of the sympathetic system, Stuebel's method was equivalent to stimulating the hepatic nerves. Possibly we were concerned in our work with the material observed by Berg and Stuebel.

We have tried to show that the effect of hepatic stimulation on the denervated heart could be produced by substances given off by the liver—the well-known products of liver activity—but in vain. Consequently we have been unable to avoid the conclusion that the accelerator substance produced by the liver is a new internal secretion.

So far as the question of tremor is concerned, let me say that we have not observed it in any of our cases of thyroid stimulation. Of course, this raises the question as to whether the increased rate of the heart is a true indicator of all the effects of thyroid hypersecretion. At present we are working on this point. It is probable that the faster heart rate does signify an increase of the metabolic rate. In one instance the increase of the heart rate following thyroid stimulation was associated with an increase of the rate of metabolism amounting to 15 per cent; as the heart rate fell the metabolic rate likewise fell.

Whether the suprarenal gland is increased in size in cases of hyperthyroidism in man is a question that I have asked a number of pathologists. Some cases of this character have been reported in the literature. I urge you as surgeons to pay especial attention to this condition in cases that may come under your observation.

So far as histological changes are concerned in glands stimulated by union of the phrenic with the cervical sympathetic, I can say that these glands were carefully studied by Homans, who found that there was evidence of hydropic degeneration similar to that seen in remnants of the islands of Langerhans in experimental diabetes. He attributed this degeneration to demands on the cells greater than they were capable of fulfilling. The appearance of the thyroid glands in our animals was not like that seen in human cases of exophthalmic goiter.

The absence of exophthalmos in certain cases of overactivity of the thyroid can be accounted for on the assumption that there is hyperthyroidism not involving cervical sympathetic stimulation; for example, in thyroid adenomata. It seems to me probable that protrusion of the eye ball is dependent on sympathetic stimulation of the smooth muscle at the back of the eye. At least, exophthalmos can thus be produced experimentally in lower animals. The fact that there are cases of *unilateral* exophthalmos in man associated with hyperthyroidism shows that the condition of exophthalmos should not be attributed to overaction of the thyroid itself. I should be inclined to regard such cases as due to overaction of the sympathetic on one side and not on the other. In this explanation I may not be correct, but at least it would account for the facts.

Dr. Dennis W. Crile read a paper on "Conservative Treatment of Fractures of Long Bones."

CORRESPONDENCE

AMERICAN MEDICAL AID FOR RUSSIA

To the Editor: As one looks over the situation of medical practice and health services throughout the world at the present time, there is one outstanding and desperate condition of immediate concern to us as physicians. The almost total destitution of the physicians in Russia, the entire lack throughout the country in hospitals, relief camps, cities and villages, of the most elementary supplies, instruments and drugs, appliances, and dressings, makes the position of our fellow practitioners in that terribly afflicted land pitiful in the extreme.

No amount of food and material relief in the form of clothing or supplies will render unnecessary the provision of those means by which the science of medicine is made effective in surgery, in medicinal therapeutics, and in the control of contagion. A sincere effort is being made by physicians here and in other cities and states, in conjunction with the American Medical Aid for Russia Committee, 103 Park Ave., New York City, to meet the urgent plea of the doctors of Russia for the simple tools of their trade, for the ordinary office supplies of soap, anæsthetics, antiseptics, and drugs to heal and relieve.

Every precauti[illegible] tion to prevent such funds, as are provided, from [illegible] generosity of donors or divert them to selfish or [illegible] markets are made available for the use [illegible] hospitals in Russia through the commissioner of health of Moscow, with the approval and personal [illegible] of [illegible] American Friends Service Committee.

Will you not patri[illegible] Gynecology and O[illegible] may be induced to bring this matter of medical relief to the [illegible] bers? Will not each physician hims[illegible] patients who receive here all of the benefits of [illegible] give, and give generously in the name of American medicine?

Faithfully yours,

[illegible], Chairman,
New York State Campaign Co[illegible]
American Medical Aid for R[illegible]

BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

ANNALS OF ROENTGENOLOGY. A SERIES OF MONOGRAPHIC ATLASES. Edited by James T. Case, M.D. vol. ii—THE PATHOLOGICAL GALL-BLADDER ROENTGENOGRAPHICALLY [illegible]. By Arthur W. George, M.D., and Ralph D. Leonard, M.D. New York: Paul B. Hoeber, 1922.

ENCYCLOPÉDIE PRATIQUE DE [illegible]. Published under direction of A. Gilbert and L. Dreyfus. vol. iv—MALADIES DE LA VESSIE. Paris: Librairie Octave Doin, 1922.

ANESTESIA LOCALE IN CHIRURGIA PEDIATRICA E IN ORTOPEDIA. By O. Nuzzi. Bologna: L. Cappelli, 1922.

THE WRITING OF MEDICAL PAPERS. By Mabel H. Mellish, Editor of the Mayo Clinic Publications. Philadelphia and London: W. B. Saunders Company, 1922.

[illegible] Sampson Handley, M.S., M.D. (Lond.), F.R.C.S. [illegible]. New York: Paul B. Hoeber [illegible].

MANUAL OF THE [illegible] AND GENERAL PRACTITIONERS. Charles H. May, M.D. [illegible]. New York: William Wood & [illegible].

[illegible] Ed. Antoine, Editors. Paris: Librairie [illegible].

[illegible] M.D.(Cantab.), F.R.C.S. [illegible]. New York: [illegible]. London and New York: [illegible].

AMERICAN COLLEGE OF SURGEONS

SUMMARY OF GROUP MEETINGS OF STATE AND PROVINCIAL SECTIONS OF THE CLINICAL CONGRESS OF THE AMERICAN COLLEGE OF SURGEONS, 1920 TO 1922

AFTER two years of experiment with sectional clinical meetings of the American College of Surgeons, it is interesting to review the progress which has been made in order to determine whether or not this program is aiding to further the ideals and purposes for which the College was created.

At the Clinical Congress of the College, held in New York in October of 1919, the Board of Regents authorized the organization of clinical sections in each of the states of the United States and in the provinces of Canada in order "to promote within the individual states and provinces the purposes for which the College was founded."

During the first year of this experiment our program consisted of clinics on the mornings of two days, two scientific sessions, and a meeting to the public. In January, 1921, this program was revised, and a hospital conference was substituted for one of the scientific sessions.

It was the original purpose to hold an annual meeting in each state and province. However, after a year of uniformly successful individual state and provincial clinical meetings, changes in their organization were considered advisable. Therefore, at the meeting of executive committees of the various states and provinces which was held during the Clinical Congress in Philadelphia in October, 1921, a group arrangement was effected to attract as speakers the very best scientific talent; to arrange for larger attendance than the Fellowship of the smaller states could provide; to relieve the various executive committees of the burden of arranging a meeting each year; and to give the Fellows of the College an opportunity to see the clinical work of their confrères in neighboring states and provinces.

This sectional grouping has not in any way impaired the individuality of the existing executive committees and committees on credentials. It is simply a union of states and provinces for better and larger meetings.

OUR DISTINGUISHED SPEAKERS

The College has been fortunate in being able to enlist the co-operation at these sectional meetings of some of the most prominent members of the profession, all of whom have contributed liberally their time and services, among them:

Willard Bartlett, St. Louis
Frederic A. Besley, Chicago
Vilray P. Blair, St. Louis
Joseph C. Bloodgood, Baltimore
Hugh Cabot, Ann Arbor
John G. Clark, Philadelphia
George W. Crile, Cleveland
William R. Cubbins, Chicago
Thomas S. Cullen, Baltimore
Carl B. Davis, Chicago
John B. Deaver, Philadelphia
Robert L. Dickinson, New York
J. M. T. Finney, Baltimore
William D. Haggard, Nashville
Carl A. Hamann, Cleveland
Jabez N. Jackson, Kansas City
Allen B. Kanavel, Chicago
Dean Lewis, Chicago
William E. Lower, Cleveland
Fred Bates Lund, Boston
Arthur T. Mann, Minneapolis
Charles H. Mayo, Rochester
C. Jeff Miller, New Orleans
Harry C. Mock, Chicago
Joseph A. Pettit, Portland
John Osborn Polak, Brooklyn
Harry M. Richter, Chicago
Major G. Seelig, St. Louis
Richard R. Smith, Grand Rapids
Howard Canning Taylor, New York
Ernest F. Tucker, Portland

Also Chancellor John G. Bowman, Pittsburgh; Mr. Robert Jolly, Houston; Dr. Malcolm T. MacEachern, Ottawa; Reverend C. B. Moulinier, S. J., Milwaukee; and Judge Harold M. Stephens, Salt Lake City.

VALUE OF SECTIONAL MEETINGS

We have received many encouraging expressions of opinion regarding the benefits which have accrued to the public, to the hospitals, to the medical profession in general, and to the Fellows

of the College in particular. Among these are the following:

Dr. Charles H. Mayo, Rochester, Minnesota: "The spirit of educational advancement in surgery, founded upon integrity, ability, and training of the surgeon, has been carried to the members of the College of Surgeons throughout our country, thus reaching many members who are unable to attend the yearly Convocations of the College and the Clinical Congress. As a Fellow and Regent of the College who has always attended the Convocations and participated in some of the sectional meetings, I feel that the College has paved the way for a great future in the surgery of our country in standardizing not only the surgeon, but the place in which he works—the hospital. This achievement is not the only benefit for the people, as is shown by their attendance at the public educational meetings concerning cancer and preventive medicine which are always held with those of the College."

Dr. Joseph C. Bloodgood, Baltimore: "These sectional meetings are essential, first, for publicity, and, second, to allow the surgical specialists to witness each other's work. The success of the Clinical Congress and later of the American College of Surgeons was due to the clinical feature of the meetings. This should be just as successful in the sectional meetings. Publicity is an obligation we owe to the community, and very important, because by the publicity of our proposed reforms we get the community behind the movement, and make it possible for the local profession to put it over."

Dr. George W. Crile, Cleveland: "The organization of the sectional meetings of the American College of Surgeons is one of the most interesting and fruitful enterprises with which I have ever had the privilege to be associated. Of course, mere impressions are of no avail unless one can analyze in what direction the benefits thereof are to be principally shown.

"It would seem that the benefits from these sectional meetings will be manifested in three distinct directions — (1) to the medical profession; (2) to the hospitals; and (3) to the public at large — although, of course, the benefits accruing to 1 and 2 would inevitably include 3.

"1. The great value to surgeons is found in the opportunity of observing the practical work of various operators in the clinic and of hearing surgical problems discussed by surgeons from other parts of the country. To those who are not surgeons and to surgeons alike there is the value of association, exchange of ideas, and a closer appreciation for each of the viewpoint of the other.

"2. The benefits to the hospitals are found in the unifying of [illegible] and [illegible] ciation thereof, wherein lies their value to the community. The better acquaintance of the lay members of their [illegible] with members of their professional staffs with the standards required for their widest efficiency cannot fail to react in a progressive development.

"3. The benefits to the lay public are found in the increasing appreciation of the [illegible] which are being demanded for their [illegible] by the medical profession; and an increased knowledge of the benefits of scientific medi[illegible] the responsibility resting upon them, then [illegible] to support and raise the standards of their hospitals."

Dr. John B. Deaver, Philadelphia: "The [illegible] tional meetings of the American Colle[illegible] geons, inaugurated two yea[illegible] ment, have so proven their value in every re[illegible] for which they were intended that th[illegible] be no question of considering them anything but an established custom, an integral part o[illegible] functioning of the College.

"To the public, they give the opportunity of hearing the message of men high in the prof[illegible] on vital subjects pertaining to public health, expressed in simple language, but based on scientific knowledge and practical experience.

"The improvement in hospital methods and management is probably the most conspicuous practical result of the policy of the College to raise the standards of surgery throughout the United States. The beginning has been well made and the results augur well for the future.

"To the profession at large the sectional meetings have been the source of valuable interchange of views on intricate and important questions in the field of medicine and surgery, and at the same time have offered the opportunity to men located remote from the larger centers of meeting personally those active and prominent in the latter. The stimulating effect of such social intercourse can scarcely be overestimated.

"Finally, the privilege of membership in the College is highly prized, and the pride in Fellowship cannot but be reflected in [illegible] members to make the influence of the American College of Surgeons felt as an important factor in the advance of surgery throughout the world."

Dr. John Osborn Polak, Brooklyn, New York: "I have been very much impressed with the reception that has been accorded [illegible] Fellows of the College who have taken part in these sectional meet[illegible]

"In the first place, the hospital meetings have brought to the attention of the staff, the trustees, the administration, and the community what is expected in the modern hospital; what can be accomplished by proper organization and the minimum standard. They have further demonstrated that in the last analysis the patient is the first consideration, and that only by such organization can that patient get the best in diagnosis in surgery, and in after-care.

"The public meetings have shown the altruism of the College and are sounding the death knell of the several pathies by showing the public what has been accomplished and can be accomplished by scientific medicine. And also that the quality of their local hospitals and the quality of their medical and surgical advisors depends wholly on their demands and on their support.

"And finally the local profession has had brought to it by these sectional meetings, the opportunity to witness excellent clinics and meet some of the leaders of the country, and from what they have told me, they have received a stimulus which has helped them in their subsequent work."

Dr. Frederic A. Besley, Chicago: "It was my privilege to attend the first four sectional meetings held by the American College of Surgeons, and I have had an opportunity to watch their growth and their influence upon the public, the hospitals, and the profession.

"The public meetings as they have been held have elicited a keen interest, as manifested by the very large attendance, and with that interest the propaganda makes for a proper understanding of the aims and traditions of the medical profession as promulgated through the activities of the American College of Surgeons, and it is bound to result in a progress that is most desirable.

"Material evidence is not wanting to point out the good that these meetings have accomplished in the elevation of the standards set by the hospitals in which the clinics were held. And this cannot but redound to the advancement of the surgical profession.

"The whole medical profession in the cities where these meetings have been held has shown a desire for a better knowledge of the objects of the American College of Surgeons, and for the most part have given very hearty approval and support.

"The Fellows of the College in the cities where sectional meetings were held came to have a fuller realization of the power and influence of their organization, and because of this have increased their activities for the good of the hospitals, the public, and the College."

Reverend C. B. Moulinier, S. J., President, Catholic Hospital Association, Milwaukee: "The audiences reached at these meetings consist of members of the medical profession, hospital and nursing professions, and the public in general. The number of each is large and practically covers the whole continent, and I believe we reach the most active and leading people concerned in better medicine and better hospital service. The audiences are growing in numbers each succeeding year and must eventually embrace the whole body of the professions and that portion of the lay public which feels the responsibility for the better care of individual and community health.

"The reasons why this propaganda conducted by the American College of Surgeons is so successful, it seems to me, can be stated in a very few simple words, as follows: The things aimed at are true, are fundamental, are all-embracing, and as a consequence are fair, just and convincing. Hence, not only the Fellows of the American College of Surgeons but every right-minded medical man, hospital executive and nurse who is endeavoring to practice medicine in the finer spirit of the professions and in keeping with the development of medical science and hospital care of patients, accepts without difficulty the program of the College.

"The program presented by the College is true and fundamental because no hospital can be conducted today, in view of the advanced knowledge of medicine and nursing, which is not carefully organized under a clear working system, which does not make faithful and complete record of all it does for its patients, and which does not furnish to the medical profession and to the nursing profession all means for up-to-date diagnosis, treatment and care. The profession is honoring itself and rising to a higher plane of service by gradually cleaning out from its temple of service those who traffic in human beings and are mere money changers in the service of the sick. Not only is it true that the hospital must conduct its work according to the plans of the College, if it would be right and fair in its dealing with its patient, but the individual doctor or any group of doctors must recognize and, thank God, are rapidly coming to see, that modern medicine must conform to what is scientifically true, ethically right, and sociologically required by the developing sense of the patient's or public's right to fair play.

"There is nothing recorded in the history of medicine so much to the honor of the medical profession as the present move for enlightened

preventive medicine and of organized curative and alleviative care of the sick in all institutions established for that noble purpose."

Dr. Malcolm T. MacEachern, Director-General, Victorian Order of Nurses for Canada, Ottawa, Canada: "The College of Surgeons accomplished a real advance in its splendid programs when it inaugurated the movement of holding meetings annually in the various sections of the United States and Canada. Probably the originators of this plan did not fully realize the far-reaching effects and general benefits of such a movement which are evidenced in the short time they have been carried on.

"These meetings are unique, dealing as they do with phases of preventive and curative medicine through a well arranged two-day program presented so as to interest all groups in the community—the public generally as well as the medical profession and the hospital people. All this has meant much for the advancement of scientific, preventive and curative medicine, as well as hospital progress and development, and the education of the public.

"Through these meetings many groups are benefited. The public generally receives valuable information on health and how to keep well through simple, comprehensive addresses on such subjects as cancer, child welfare, social diseases and other matters pertaining to public health. The public also has an opportunity of understanding more clearly the real value and saneness of curative medicine, and especially the importance to the community of good hospital service. The obligation of the public in respect to the latter is forcefully brought out.

"Through the local meetings the medical profession generally is afforded an opportunity to hear worth-while addresses on scientific subjects as well as to observe excellent work carried on in the clinics conducted in the leading hospitals by Fellows of the College. Such an opportunity is of value particularly to the members of the local profession who cannot frequently visit other centers to advance their knowledge.

"The meetings mean a great deal to our hospitals, not only in the assistance rendered the hospital groups in the solution of their problem generally and particularly in the standardization movement, but also in the publicity given to such work with the resulting stimulus and enthusiasm created thereby. During the two days the hospitals have the advantage of the assistance rendered by the experts present, most of which is accomplished through the afternoon hospital meeting with the round-table conference, the public meeting in the evening, and group and individual consultations throughout the two-day period.

"The members of the College are able to keep closely in touch with the parent organization, which is a great advantage to the many who cannot attend the annual conferences regularly. And, finally, the sectional meetings foster greater stimulation and enthusiasm amongst the individual members of the College and promote a better bond of interest and loyalty to the ideals and objectives set forth by the College."

THE MEETING FOR THE LAITY

As an indication of the interest manifested in our public meetings by the laity, practically every meeting which has been held has been addressed by either the governor of the state, the mayor of the city, a judge, a senator or representative, or some other prominent citizen, and after the meeting many of these individuals have directed letters to the offices of the College expressing their appreciation for what the College has done in their respective communities.

Among the subjects which have been presented at the public meetings by leaders of the profession are the following:

The American College of Surgeons and its relation to the public; better hospitals; the laymen's interest in hospitals; means through which the public can aid the medical profession; how the public can assist in reducing the mortality of cancer; experimental medicine and its value to the public; why the church is interested in the medical education of the laity; the control of cancer; the advantage to the community of scientific research; the economic value to the community of prenatal work; the benefits to be derived by the public through co-operation with the American College of Surgeons; how modern medicine can be of service to the laity; the importance of the early recognition of cancer; what the public should know about cancer; the menace of cancer; the public health and the community responsibility; the relation of the hospital to the community; experimental medicine and its relation to public health; cancer as a community problem; surgical researches in peace and war; what the public should know about preventive medicine; what the surgeon is doing to limit the necessity for operation; the work of the American Society for the Control of Cancer and its relation to the community; the public's duty in supporting the scientific medicine is doing for the protection of the

importance of the early recognition by the general public of goiter.

In addition to the above, the prominent surgeons who have attended the sectional meetings have made innumerable talks before Rotary Clubs, Chambers of Commerce, Women's Clubs, Teachers' Associations, etc., at the request of officials of these organizations.

SECTIONAL MEETINGS HELD

A chronological summary of state and provincial meetings which have already been held follows:

	1920	States and provinces represented
September 3, 4	Butte	Montana
September 6, 7	Boise	Idaho
September 10, 11	Portland	Oregon
September 13–15	Seattle	Washington
October 7–9	Pittsburgh	Pennsylvania
November 15, 16	Phoenix	Arizona, New Mexico
November 18, 19	San Francisco	California, Nevada
November 22, 23	Salt Lake City	Utah
November 26, 27	Denver	Colorado, Wyoming
December 2, 3	Buffalo	New York
December 16–18	Peoria	Illinois
	1921	
January 7, 8	Dallas	Texas
January 10, 11	New Orleans	Louisiana, Mississippi
January 14, 15	Atlanta	Georgia, Alabama, Florida
January 17, 18	Charleston	South Carolina
January 20, 21	Charlotte	North Carolina
February 18, 19	Little Rock	Arkansas
February 21, 22	Oklahoma City	Oklahoma
February 28, March 1	Des Moines	Iowa
March 3, 4	Omaha	Nebraska
March 7, 8	Wichita	Kansas
March 10, 11	St. Louis	Missouri
March 21, 22	Nashville	Tennessee
March 25, 26	Louisville	Kentucky
April 1, 2	Cleveland	Ohio
April 11, 12	Newark	New Jersey
April 14, 15	Richmond	Virginia
April 18, 19	Wheeling	West Virginia
April 28, 29	Detroit	Michigan
May 2, 3	Indianapolis	Indiana
May 10	Baltimore	Maryland, District of Columbia
May 11	Washington	District of Columbia, Maryland
May 13, 14	Springfield	New England States
June 14, 15	Bismarck	North Dakota
June 17, 18	Aberdeen	South Dakota
August 16–19	Calgary	Alberta, Saskatchewan
August 23, 25	Vancouver	British Columbia
August 25, 26	Spokane	Washington
August 30, 31	Portland	Oregon
	1922	
January 6	St. Paul	Minnesota, Montana, North Dakota, Wisconsin
February 6, 7	Lincoln	Nebraska, Iowa, South Dakota
February 9, 10	Kansas City	Missouri, Kansas
February 17, 18	Los Angeles	California, Arizona, Nevada
February 23, 24	Houston	Texas, New Mexico Oklahoma
February 27, 28	Memphis	Tennessee, Arkansas, Kentucky
March 2, 3	Birmingham	Alabama, Florida, Georgia, Louisiana, Mississippi
March 20, 21	Asheville	North Carolina, South Carolina
April 3, 4	Allentown	Pennsylvania, New Jersey, Delaware
May 15, 16	Portland	New England States
May 19, 20	Halifax	Maritime Provinces

Our sectional meetings could not have been successful if we had not had the co-operation of the local medical profession, lay organizations, and public officials, and if the local committees had not been untiring in their efforts in behalf of the College. Likewise, the willingness of the leaders of our profession to address these meetings, even when they were held in sections of the country far removed from their homes, has been responsible in a large measure for our splendid results.

Expressions of appreciation which have been received from hospital officials, prominent laymen and women, Fellows of the College, and members of the profession outside of the College, lead to the conclusion that the sectional meetings should be continued, and that they should be made a permanent feature of the American College of Surgeons.

THE DEPARTMENT OF LITERARY RESEARCH DEFINED; SPECIAL SERVICE OFFERED PHYSICIANS AND SURGEONS BY THIS DEPARTMENT OF THE AMERICAN COLLEGE OF SURGEONS

ABOUT a year ago, the Department of Literary Research of the American College of Surgeons organized a small group of specially trained workers to prepare bibliographies, abstracts, and translations of medical and surgical literature; and this service was offered to surgeons in connection with their preparation of surgical papers, reporting of unique cases, and special research work.

The Department has received requests for the service on a great variety of subjects from the Fellows of the College in all parts of the country, South America, Canada, and England, and a few requests have come from professional men outside of the College.

The experience of the Department in meeting these requests has gradually evolved a standard procedure. It is the purpose of this article to present a brief outline to show more clearly the nature of the service furnished and to help those interested to know just how best fully to utilize the work of the Department.

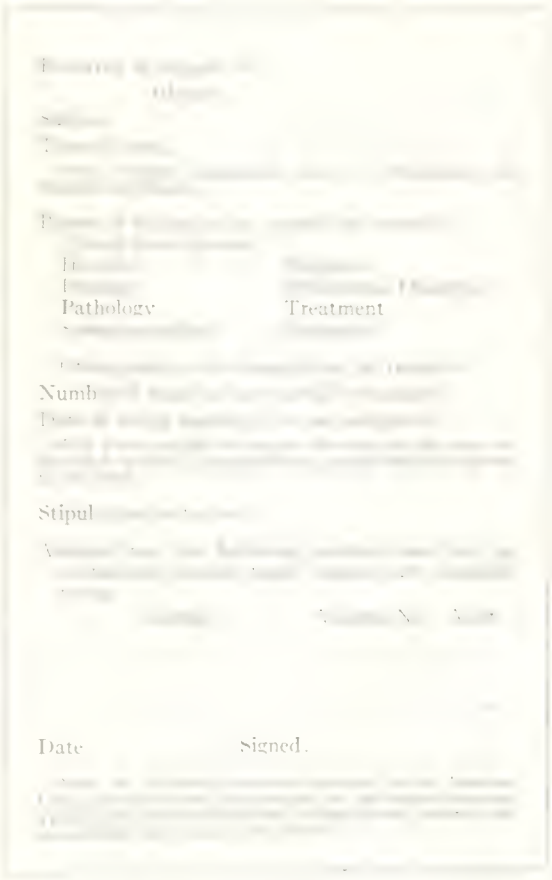
Finding out what the surgeon wants. A small reproduction of the blank which is sent out to the surgeon before any piece of work is undertaken is shown on this page.

Time of application for service. One of the most important points on this blank is the date line.

The natural tendency is for the requests to come in just before the spring and fall meetings. Whenever it is possible it will be to the advantage of the surgeon to make his application for the research work far in advance of the need for the finished material. This allows for careful planning of the work, and source material not immediately available can be secured in time to be included.

A small staff. The Department maintains a small staff since the highly specialized nature of the work requires a careful selection of workers and a thorough training in the field. Requests at any one time will not be accepted in such a wholesale manner that the work cannot be carried on under medical supervision and provision made for checking by a qualified physician of all material sent out by the Department. This necessitates an even distribution of requests throughout the year.

Follow up. If the material is received by the surgeon in advance of the time he needs to make


Pathology Treatment

Date Signed.

opportunity is afforded for him to write in and ask for additional material on certain phases of the work or to send in questions in regard to anything that has not been clearly presented.

Bibliographies. Bibliographies are compiled from *Index Medicus*, INTERNATIONAL ABSTRACT *Quarterly Cumulative In* *of the Surgeon General's Library*, and from all available sources. They are prepared in standard form and typed on cards of a standard size that they can be filed in alphabetical arrangement. They should be kept by the surgeon at least until the final checking of the completed work, as *value of any piece of scientific research.*

If a limited or selected bibliography is desired by the physician the Department undertakes the unbiased selection of leading articles that appear to be particularly in point.

Abstracts. With a blank filled out showing just what phases of the subject the physician wishes to have covered, abstracts are made with his interests in mind. Such abstracts are more useful and save more of the surgeon's time than abstracts made for general publication. It is the aim of the workers to present the opinions and arguments of the writers in an unbiased manner. The abstracts are typewritten on good quality paper, arranged alphabetically, and, when time permits, they are indexed or classified in some way for ready reference.

Translations. Special care is exercised in the abstracting of articles in foreign languages, and whenever desired the Department is glad to furnish full translations of important foreign articles in the interest of greater accuracy and to present a clearer picture of the material in the original source.

Cost of research service. Under the present arrangement the cost of supervision of the work is carried by the College. Moreover, very valuable service is secured from members of the consulting staff, who are leading surgeons connected with the College, in instances where the subject is a particularly difficult one or where the lack of published material requires the seeking of the advice of a specialist.

Careful research service, however, necessarily requires the expenditure of considerable time by the library workers, and where a piece of work of any size is required the physician should be prepared to make an expenditure accordingly.

Complete research work. It is the aim of the College so to develop its staff of workers and organize its procedure that complete research service can be brought within the practical reach of more investigators. In undertaking to cover a subject fully, the bibliography is first made as complete as possible. The leading articles are abstracted first and the bulk of the literature is then grouped with a view to covering all phases of the subject, outlining new tendencies, and presenting new experiments in the field, with unimportant literature properly subordinated.

A limited service. A more limited service may meet the physician's needs. In this case, in addition to limiting the phases of the subject to be covered, use may be made of the *physician's library* and the *College package library.* The physician indicates the journals and books on the subject which are available to him and references to such sources are included in the bibliography but not abstracted. The College is also rapidly accumulating a package library, material from which is loaned to the profession without charge. This also eliminates the necessity of abstracting all articles available from this source.

CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

TWELFTH ANNUAL SESSION, BOSTON, OCTOBER 23-27, 1922

JOHN B. DEAVER, Philadelphia, *President*

HARVEY CUSHING, Boston, *President-Elect* ALBERT J. OCHSNER, Chicago, *Treasurer*

FRANKLIN H. MARTIN, Chicago, *Director-General*

COMMITTEE ON ARRANGEMENTS

LINCOLN DAVIS, [illegible] W. JAMES MINOR [illegible]

CAPT. N. J. BLACKWOOD	[illegible]	WILLIAM P. G[illegible]	[illegible]
JOHN T. BOTTOMLEY	J. H. [illegible]	R. B. GREENOUGH	[illegible]
GEORGE W. W. BREWSTER	[illegible]	GEORGE F. KEENAN	[illegible]
J. EMMONS BRIGGS	[illegible]	FRANK H. LAHEY	[illegible]
FREDERICK J. [illegible]	[illegible]	FRED B. LUND	[illegible]

PLANS FOR THE CLINICAL CONGRESS IN BOSTON

MONDAY, October 23—the first day of the twelfth annual session of the Clinical Congress of the American College of Surgeons in Boston—will be devoted to an all-day conference on the problems related to the Hospital Standardization program of the American College of Surgeons. Sessions will be held both morning and afternoon in Jordan Hall at which the problems will be discussed by Fellows of the College, hospital superintendents, trustees, nurses, and others interested in the development and maintenance of hospitals.

The first formal session of the Congress—the Presidential meeting—will be held on Monday evening in Symphony Hall. This will be the occasion of the inauguration of the President-Elect, Dr. Harvey Cushing, who will deliver the annual address. Another feature of that evening will be the John B. Murphy Oration in surgery by Professor Raffaele Bastianelli of Rome, Italy.

The plans for the Boston meeting will in a general way conform to those of previous sessions of the Congress, with clinical demonstrations at the hospitals and medical schools during the morning and afternoon of each of the four days of the Congress—Tuesday to Friday, inclusive—with scientific sessions each evening. A program of clinics and demonstrations is being developed by the Committee on Arrangements that will accurately and completely represent the clinical activities of that great medical center. In this clinical program all departments of surgery will be represented including gynecology, obstetrics, orthopedics, urology, surgery of the eye, ear, nose, throat and mouth, experimental surgery, surgical pathology, roentgenology, etc.

Institutions which will co-operate in providing the clinical program are as follows: Harvard Medical School, Boston University Medical School, Tufts College Medical School, Beth Israel Hospital, Evangeline Booth Hospital, Boston City Hospital, Boston Dispensary, Boston Lying-In Hospital, Peter Bent Brigham Hospital, Cambridge Hospital, Carney Hospital, Children's Hospital, Forsythe Dental Infirmary, Free Hospital for Women, Huntington Memorial Hospital, Long Island Hospital, Massachusetts Charitable Eye and Ear Infirmary, Massachusetts General Hospital, Massachusetts Homeopathic Hospital, New England Deaconess Hospital, New England Hospital for Women and Children, St. Elizabeth's Hospital, U. S. Naval Hospital.

Members of the Congress will be guests of the Boston Surgical Society on Wednesday evening at a special meeting in Jordan Hall, when the Henry Jacob Bigelow [illegible] will be presented to Dr. William Williams Keen of Philadelphia.

The Executive Committee of the Congress is [illegible] program of papers and [illegible]ling with live surgical subjects for [illegible] to be held in Jordan Hall on Tuesday [illegible] evenings. Papers will be read by eminent American and European surgeons who have been specially invited to contribute because of their wide experience in dealing with the conditions under discussion.

On Friday evening in Symphony Hall, at the tenth convocation of the American College of Surgeons, fellowship in the College will be conferred upon a group of American and Canadian [illegible], and honorary fellowships upon the distinguished foreign guests. The fellowship address will be given by Professor Raffaele B[illegible]tianelli.

General headquarters for the Congress will be at the Copley-Plaza Hotel where the large ballroom, foyers adjacent thereto, and other large rooms on the main floor have been reserved for the use of the Congress, and will be utilized for the registration and ticket bureaus, bulletin rooms, etc.

HOTEL ACCOMMODATIONS

To facilitate obtaining hotel accommodations by Fellows who will attend the Boston meeting, the Committee on Arrangements has appointed a Committee on Hotels, with Dr. Stephen Rushmore as Chairman. Fellows are requested to make application for reservations direct to the hotels named in the list recommended by the Committee as printed below. Where difficulty is experienced in securing proper accommodations, the matter should be taken up with Dr. Rushmore, 520 Commonwealth Avenue, Boston. Boston has ample hotel facilities, many first-class hotels being located within short walking distance of headquarters.

LIMITED ATTENDANCE—ADVANCE REGISTRATION

Because of the popularity of these annual clinical meetings it has been found necessary in recent years to adopt the plan of limiting attendance, which plan requires registration in advance on the part of all who expect to attend. The limit of attendance is based upon the result of a survey of the amphitheaters, lecture rooms, and laboratories of the several hospitals and medical schools as to their capacity for accommodating visitors. When such limit of attendance has been reached through advance registration at the office of the College, no further applications can be accepted, hence the necessity for early registration. Based upon our experience in recent years, it is probable that the limit of attendance will be reached some weeks in advance of the meeting.

BOSTON HOTELS WITH RATES

	Single Room		Double Room	
	With Bath	Without	With Bath	Without
Adams House, 553 Washington St.			6.00–7.00	3.50–4.50
American House, 56 Hanover St.			6.00	4.00
Arlington, 18 Chandler St.	2.50–3.00		4.00–5.00	
Avery, 24 Avery St.			6.00	
Bellevue, 21 Beacon St.			8.00–10.00	4.00–6.00
Brewster, 19 Boylston St.	3.00–4.00	2.50–3.00	5.00–7.00	
Brunswick, Boylston and Clarendon	4.00	3.00	6.00–7.00	5.00
Buckminster, 641 Beacon St.	3.00	2.50	6.00	5.00
Commonwealth, Bowdoin St.			5.00	
Copley Plaza, Copley Square	6.00		11.00	
Copley Square, 49 Huntington Ave.	4.00		6.00	
Essex, 693 Atlantic Ave.	5.00	3.00–3.50	7.00–8.00	
Fritz-Carleton, 1138 Boylston St.		3.00	8.00–10.00	4.50
Garrison Hall, 8 Garrison St.	3.00		5.00	
[illegible]gham, 1699 Washington St.	3.00	2.00	4.00	3.00
Lenox, Exeter and Boylston	5.00	3.50	8.00	5.00
Parker House, School and Tremont	5.50–7.00	4.00–4.50	5.50–7.00	5.00
Plaza, 419 Columbus Ave.			5.00	3.00
[illegible] n only), 307 Huntington Ave.	3.00		4.50–6.00	
Puritan, 390 Commonwealth Ave.	5.00	2.50	6.00	
Putnam, 284 Huntington Ave.		2.00–3.00		3.00–4.00
[illegible] St.	3.50	2.00–2.50	6.00–7.00	3.50–4.00
Ranelegh, 11 Mountfort St.			5.00	
[illegible] and Charles-gate			10.00	5.00
Stewart Club (women only), 102 Fenway		3.50		6.00
United States, 00 Beach St.		2.50		4.00
[illegible] Commonwealth and Dartmouth.	8.00		14.00–16.00	
Victoria, 271 Dartmouth St.	4.00	3.00	6.00	5.00
Westminster, Copley Square	4.00	2.50	7.00	3.50
Young's, Court and City Hall			7.00–8.00	4.50–5.00

Fig. A. Granulation tissue at the umbilicus. (Gyn.-Path. No. 20401.)

Fig. B. An umbilical polyp. (C.H.I. No. 18[illegible]5)

Fig. C. Large indurated umbilicus with reddish tissue in the center. (Dr. Winslow's case.)

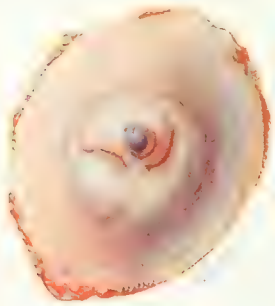


Fig. D. Nævus of the umbilicus. (Gyn.-Path. No. 24661.)

PLATE I.

Notes on Diseases of the Umbilicus.—Thomas S. Cullen.

SURGERY, GYNECOLOGY AND OBSTETRICS

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FURTHER NOTES ON DISEASES OF THE UMBILICUS

BY THOMAS S. CULLEN, M.B., BALTIMORE

From the Gynecological Department of the Johns Hopkins Hospital and the Johns Hopkins Medical School

OUTLINE

Tetanus in the Newborn
Granulation Tissue at the Umbilicus in the Newborn
Umbilical Polyps of Omphalomesenteric Duct Origin
Meckel's Diverticulum
  a. Gastric Mucosa in the Tip of
  b. An Accessory Pancreas in the Tip of
  c. A Pin Embedded in the Wall of
  d. Sarcoma of
Umbilical Concretions Associated with Inflammatory Changes in the Abdominal Wall
A Tuberculous Abscess Opening at the Umbilicus
Probable Psoriasis at the Umbilicus
Syphilitic Condyloma of the Umbilicus
Bluish Discoloration of the Umbilicus as a Diagnostic Sign in Ruptured Extra-uterine Pregnancy
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Nævus of the Umbilicus
Moles of the Umbilicus
Papilloma of the Umbilicus
Pseudomucinous Cysts of the Umbilicus Secondary to a Pseudomucinous Cyst of the Ovary
Carcinoma of the Umbilicus
  1. Primary Squamous-Cell
  2. Secondary to Carcinoma of Stomach
  3. Secondary to Carcinoma of Intestine
  4. Secondary to Carcinoma of Rectum
  5. Secondary, Original Source Not Determined
Sarcoma of the Umbilicus, secondary
Amnion Umbilicus
Umbilical Hernia at Birth
  1. Uncomplicated
  2. Strangulated and Associated with Peritonitis
A Satisfactory Method of Dealing with Intestinal Loops Densely Adherent to the Walls of an Umbilical Hernia
Persistence of the Urachus
Comment

SINCE the appearance of my book on diseases of the umbilicus,[2] six years ago, quite a number of American surgeons and pathologists have been good enough to draw my attention to cases coming under their notice, and quite a few have sent me the specimens for study.

During this period I have seen and operated on a goodly number of such cases. In the present paper I shall refer briefly to these cases, but shall not attempt to include the recent literature on the subject. To enter into a full discussion of the various lesions here considered would be a needless repetition, inasmuch as nearly all umbilical and urachal diseases were more or less fully analyzed in my book. Where necessary I shall, in a footnote, refer the reader to the page in the original volume where a full discussion of the given subject may be found.

TETANUS IN THE NEWBORN IN CHINA

During the summer of 1910 Dr. Jennie M. Logan, who had just returned from China,

[illegible]

PLATE I

Fig. A [illegible]
No. 10153.
Fig. B [illegible]
No. 15[illegible].
Fig. C [illegible]
Fig. D [illegible]
No. 24[illegible].

[illegible]

visited Baltimore and we were discussing tetanus in the newborn. Her description of the appalling lack of asepsis during labor among the poor Chinese women of Hunan Province was so vivid that I asked her if she would not write me a short account of what she had actually witnessed there. Under date of October 11, 1916, Dr. Logan wrote from Boston, as follows:

"The usual preparation for lying in by a poor Chinese woman in Hunan Province consists in getting together a roll of the cheapest paper made of straw, a large, old, low wash-tub about 4 or 5 inches deep, a small wooden stool 6 inches high to sit on in the tub, two shovelfuls of wood ashes wrapped in the straw paper for the bed, an old pair of scissors, a slop bucket, and a string.

"The mother sits on the stool, leaning against a friend or a washstand, the child is born into the tub, which already holds the amniotic fluid and previous discharge, and is caught up by the midwife or a neighbor; the cord is tied with any old string and the child rolled into the oldest, dirtiest garment the household affords. With such ushering into life it is small wonder that in our women's dispensary there are frequent cases of tetanus neonatorum. The person who brings the child generally tells us that the baby won't nurse. One finds the muscles convulsed, the little jaw rigid, and the umbilicus either red or angry-looking, or quite black and foul-smelling. The child is almost invariably about 10 days old.

"Just before the end of May a case came in with the mouth open though the jaws were perfectly rigid and could not be budged either to open or to close the mouth further. The hands too were not quite closed even during the convulsion but were perfectly stiff.

"We have had such cases for a period of 18 years in the dispensary, and of late have not tried to help them in any way as it always was hopeless, and the attempt and failure did not help our work."

Dr. L. M. Miles, who soon goes to the gynecological department of the Peking Medical School, and who has been working with me in the gynecological department for the past year, has on several occasions spoken to me of the treatment of the umbilical cord in the part of China in which he has lived, and has drawn attention to the great frequency with which the newborn child develops tetanus. The reason why is clearly shown in the accompanying description.

Under the heading "The Treatment of the Umbilical Cord and of the Newborn Babe in Shantung Province, China," Dr. Miles writes: "The people of Shantung Province of China are for the most part poverty-stricken. Hence they cannot afford even the simplest of layettes for the newborn babies. Cotton cloth for diapers is out of the question because of cost. Consequently they have striven to find the cheapest possible substitute. This consists of a bag of coarse, native woven cotton cloth which fits the baby loosely and encloses it from the axillæ down.

"As soon as the child is born, the cord is tied with any old whisp of string and the baby is placed in this bag, which is then filled with dry dust from the field or street and the bag is then tied around the child's body. Under favorable circumstances the bag may be emptied and fresh dust substituted in a few days; in winter, when the ground is frozen, the dirt may merely be dried out over the fire and replaced in the bag.

"Such a procedure is, as can well be imagined, often followed by tetanus neonatorum. It will be erring on the side of conservatism to say that 50 per cent of the babies thus cared for die within the first 10 days of life."

GRANULATION TISSUE AT THE UMBILICUS IN THE NEWBORN[1]

In these cases the umbilical stump does not heal kindly. A small red mass is found in the umbilical depression, and from it there is usually a slight discharge of pus. When one examines the small red mass, it is usually found to be flabby, but in the case shown in Plate I, A, it was unusually firm.

On microscopic examination these growths are found to consist of granulation tissue.

[1] Diseases of the Umbilicus, p. 116.

The surface is covered with polymorphonuclear leucocytes. The outer layers are composed of granulation tissue and the central portion may be more or less organized (Fig. 1). Such small masses are totally devoid of epithelium.

Granulation Tissue at the Umbilicus with No

I saw C. W., a colored baby, 1 month old, at the Harriet Lane Home on December [illegible]. No abnormality at the umbilicus had been noted at birth. Two weeks before admission the child had had a three-hour crying spell, and discharged a considerable amount of blood from the navel. Since this time there had been a constant yellow discharge from the navel and the mother thought that the protrusion had become larger.

Operation. The small growth was gently lifted up with broad pointed stomach clips and the base ligated with one plain catgut ligature. The growth was then cut away.

Gyn. Path. No. 20305. The surface of the polyp is covered with polymorphonuclear leucocytes and fibrin. Beneath this is typical granulation tissue. The central portion of the polyp shows fairly well organized connective tissue. At some points are areas of œdema. Clinically, it bore a striking resemblance to an umbilical polyp due to remnants of the outer end of the omphalomesenteric duct. Histologically, however, no such similarity was found.

An Umbilical Polyp Consisting of Granulation Tissue

Surgical No. 46938. G. C., age 1 month, was admitted to the Harriet Lane Home on December 3, 1918. He had vomited occasionally since birth. The navel had never healed and protruded, especially when the child cried. There was some foul-smelling discharge coming from the umbilicus.

On examination a firm, lobulated, red, glistening, pedunculated tumor, about 6 millimeters in diameter, was found projecting from the umbilical depression. The firmness of the tumor suggested an umbilical polyp due to the persistence of the outer end of the omphalomesenteric duct.

Operation, December [illegible], 1918. With intestinal clips I grasped the skin close to the umbilicus on each side to make the tissues taut. An elliptical incision was then made, and the umbilicus removed. The excision extended down to the peritoneum.

The convalescence was uneventful.

Gyn. Path. No. 24515. The surface of the polyp (Fig. 1) is covered by polymorphonuclear leucocytes. The superficial layers of the nodule are composed of typical granulation tissue, there being many young capillaries with young connective tissue cells and polymorphonuclear leucocytes between them. The central portion of the polyp consists of connective tissue, rich in capillaries. Scattered throughout it are many young connective-tissue cells. Very few polymorphonuclear leucocytes are to be noted in the central portion of the polyp.

Fig. 1. [illegible] tissue.

[illegible] mous epithelium of the umbilicus presents the usual appearance. [illegible] tive tissue, rich in capillaries.

From the above it is clearly evident that the polyp consisted essentially of granulation tissue, no epithelial elements being present.

The squamous epithelium of the umbilicus showed some polymorphonuclear infiltration near the pedicle of the polyp.

It is unusual to find [illegible] umbilical polyp unless it is due to a remnant of the omphalomesenteric duct. Where such is the case, little or no inflammation exists. The outer surface is covered by intestinal mucosa, and the center contains strands of non-striped muscle.

Clinically, this polyp bore a striking resemblance to a polyp of omphalomesenteric origin; histologically, however, no such similarity existed.

UMBILICAL POLYPS OF OMPHALOMESENTERIC DUCT ORIGIN.

Occasionally when the [illegible] a bright red polyp is noted in the umbilical

Fig. 2. An umbilical polyp associated with a Meckel's diverticulum.

C. H. I. No. 18780. An elliptical incision, including the umbilical polyp, has been made and the umbilicus lifted well away from the abdominal wall. Passing off from the loop of small bowel is a Meckel's diverticulum. This is firmly fixed to the inner surface of the umbilicus. Firmly attached to the outer surface of the umbilicus is the umbilical polyp. The small hole noted on the surface of the polyp, and into which a probe can be carried for 8 millimeters, is evidently the remnant of the lumen which formerly was continuous with Meckel's diverticulum. Both the omphalomesenteric artery and vein still persist. They pass from the mesentery of the small bowel over the surface of the bowel and along the diverticulum to the umbilicus. For the histological picture of the umbilical polyp see Figure 3.

depression. When this does not consist of granulation tissue, it is usually the remains of the outer end of the omphalomesenteric duct.

Granulation tissue usually soon dries up under astringent treatment, whereas the polyp consisting of embryonic remains persists.

Case C. H. I. 18780 is a notable example of the umbilical polyp originating from the omphalomesenteric duct. In Plate I, B, we see the bright red polyp welling out of the umbilicus and secreting a relatively clear fluid. Roughly the polyp resembles a cherry. It is 1 centimeter in diameter. Near the middle is a roundish elevat on. At this point a probe could be carried into the polyp for 8 millimeters. The growth was covered by a definite mucosa, which on histological examination was found to be typical mucosa of the small bowel (Fig. 3). On the surface are a few drops of mucus and a large drop has just fallen off on to the abdomen. Figure 2 shows that there is also a Meckel's diverticulum which extends up to and is blended with the abdominal wall at the umbilicus.

This case came within an ace of being one of patent omphalomesenteric duct. Had this been true fæcal matter would have escaped from the umbilicus as soon as the cord came away. In some cases the polyp is the only remnant of the omphalomesenteric duct, in some the vessels of Meckel's diverticulum persist and are adherent to the abdominal wall; occasionally, the duct is

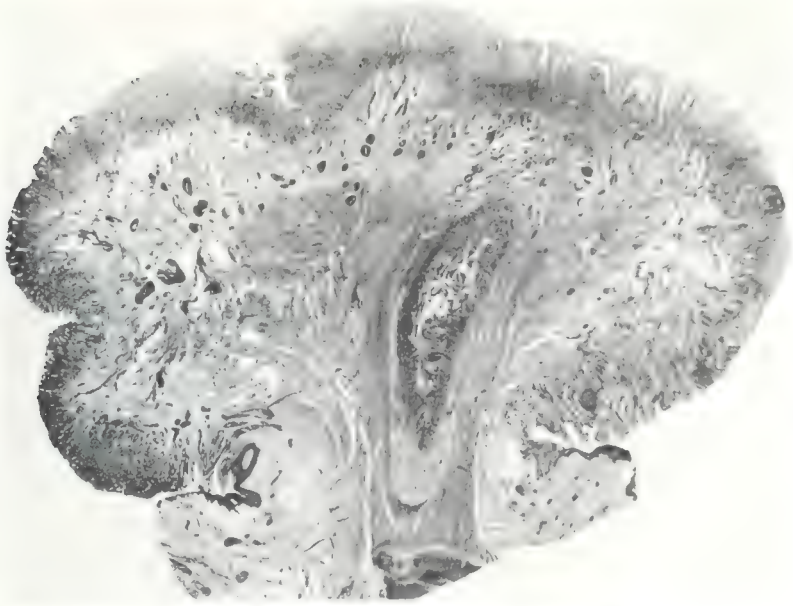

Fig. 3. An umbilical polyp covered over by intestinal mucosa.

C. H. I. No. 18780. From a section through the fiery red polyp seen in Plate I, B. In this case a Meckel's diverticulum existed and was attached to the umbilicus (Fig. 2). In the lower part of the picture one sees the squamous epithelium. Covering the polyp is typical mucosa of the small bowel. In this case a probe could be carried down through the polyp for some distance. The cavity in the center of the polyp is formed by an oblique section of this fistulous tract. This tract also is lined with mucosa of the small bowel, and represents the outer end of the omphalomesenteric duct. In the center of the polyp is much non-striped muscle, which encircles the fistulous tract.

patent and the polyp also exists. Cases of 2 remnants of the omphalomesenteric duct form a most interesting group.

Dr. Randolph Winslow's case bore much resemblance to the one here reported.

Dr. R. M. Harbin[1] of Rome, Georgia, in a short but interesting article published in 1917, reported several cases somewhat similar in character.

Umbilical Polyp Associated with a Meckel's Diverticulum

C. H. I. No. 18780. J. A., 1 year old, was admitted to the Church Home and Infirmary, March 30, 1918. This child had at the navel a bright red mass, about 1.5 centimeters in diameter (Plate I, B). This was first noted when the cord came away. It was slightly lobulated and at one point a probe could be carried down for about 8 millimeters. In lifting up this mass, it was found to be surrounded on all sides by normal skin which extended up over its surface for about 7 millimeters.

Operation. We made an elliptical incision which encircled the umbilicus and gradually cut down until we got to the peritoneum. The peritoneum was severed on all sides and we were able to raise the umbilicus with the tumor and the underlying tissue away from the abdominal wall (Fig. 2). When the umbilical tumor with the surrounding skin was lifted up, a loop of small bowel emerged through the umbilical opening and we found that we were dealing with an umbilical polyp firmly adherent to the umbilical depression and that this was continuous with a Meckel's diverticulum. We placed a purse-string suture around the base of Meckel's diverticulum exactly as in the case of an appendix operation. After severing the diverticulum with the cautery, we turned in the stump and tied the purse-string. This was reinforced by three fine mattress sutures of black silk. The peritoneum and fascia were closed with two rows of mattress sutures of chromacized catgut, the adipose tissue was brought together with fine catgut and the skin with black silk. The child stood the operation well.

April 1. Last night the child's respirations became accelerated, it grew restless, and the pulse became rapid. This morning the respirations were 60. After an enema the child had a small stool.

[1] R. M. Harbin. Meckel diverticulum with special reference to umbilical disorders of infancy. Southern M. J., 1917, Feb., 142.

Plate I. C. gives the appearance of the indurated umbilicus with the reddish area in the center. Below the umbilicus in the mid-line is a definite dome-like swelling. [illegible] by Dr. Randolph Winslow.

Dr. Charles L. Summers made out a definite bronchopneumonia in the lower lobes of both lungs and a very unfavorable prognosis was given. The child died at 6 p. m.

At autopsy we found the bowel above the point of operation considerably distended, whereas below the point of attachment of Meckel's diverticulum it was somewhat contracted. The stump of Meckel's diverticulum that had been turned in had become congested and partly filled the lumen of the bowel. There was no fluid in the abdomen and no evidence of peritonitis. There was a definite bronchopneumonia in the lower lobes of both lungs.

In this case the bowel was very small, so small that when the stump of Meckel's diverticulum had been turned into it its lumen was considerably narrowed. We noted this carefully at operation, but the lumen apparently was still sufficient. Autopsy, however, showed that the inverted stump had swollen up after operation and almost completely blocked the bowel. In subsequent cases I should be inclined to leave little if any stump to the diverticulum but cut it off almost flush with the lumen of the bowel and close this opening just as one would an ordinary linear incision in the gut, namely, with two rows of continuous silk, a very narrow margin of the gut being turned in, in view of the fact that the lumen is naturally so small in the young child. If closure be made transverse to long axis of the bowel, there will be less narrowing of the lumen.

A Meckel's Diverticulum Associated with an Umbili[illegible] Dr. Randolph Winslow's Case

On April 1, 1918, Dr. Randolph Winslow sent me two pictures of a case which had come under his observation. In this small child the umbilical region was represented by a large, indurated area in the center of which was reddish tissue. When the child lay in the dorsal position (Fig. 4 and projected drawing, [Plate I, C]) a marked prominence of the abdomen was apparent just below the umbilicus. Dr. Winslow said that in this case a Meckel's diverticulum was adherent to the indurated umbilicus. He removed the diverticulum and the umbilicus. In all probability the reddish area in the center of the umbilical depression was a remnant of the outer end of the omphalomesenteric duct.

MECKEL'S DIVERTICULUM

In my book on *Diseases of the Umbilicus* I did not attempt to discuss abnormalities or diseases of Meckel's diverticulum with any degree of fulness, but confined my attention in the main to a consideration of those abnormalities of the diverticulum that were closely associated with lesions at the navel. However, as Meckel's diverticulum is the inner end of the omphalomesenteric duct which in early embryonic life opens at the umbilicus, it is due some consideration.

Gastric Mucosa in the Tip of Meckel's Diverticulum

Emil Goetsch,[1] in 1919, reported the case of a man, 19 years of age, who had intestinal obstruction due to a Meckel's diverticulum which was adherent to the abdominal wall and to the omentum. The patient made a good recovery. Goetsch found the proximal end of the diverticulum lined with intestinal mucosa, but the distal portion for at least 1.5 centimeters was lined with a mucosa totally different in character. This on histological examination proved to be gastric mucosa. The case was most carefully studied from every standpoint and was well illustrated. Goetsch's paper should be read by everyone interested in the subject. Accompanying the article is a complete bibliography.

An Accessory Pancreas in the Tip of Meckel's Diverticulum

Elsewhere[2] I referred briefly to a case reported by Bize, in which an accessory

[1] Emil Goetsch: [illegible] Meckel [illegible] Hosp. Rep., 1919, xxx, 1.

[2] Diseases of the Umbilicus, p. 1.

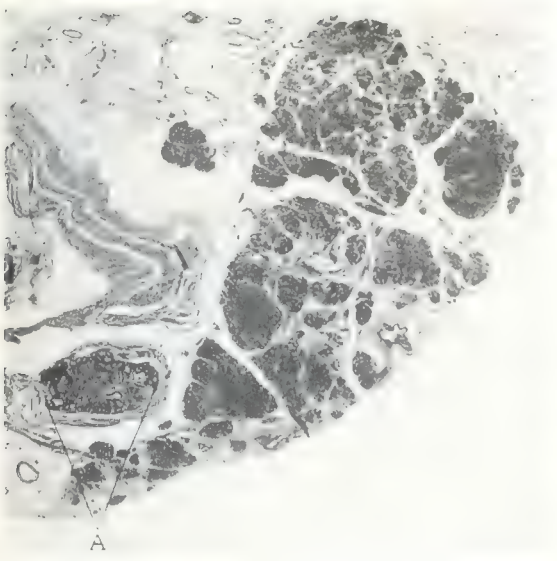

Fig. 5. An accessory pancreas in the tip of Meckel's diverticulum.

This is a very low power photomicrograph of a portion of the tip of Meckel's diverticulum sent me by Dr. Douglas Symmers. The specimen is very thick and the picture is shown merely to give the reader an idea of the location of the pancreatic tissue. *a*, Is the extreme tip of the diverticulum distal to the point where a lumen exists. All the other dark areas consist of pancreatic tissue.

pancreas was found in the tip of Meckel's diverticulum. In the literature accompanying Goetsch's article are references to quite a number of similar cases.

On April 1, 1920, Dr. Douglas Symmers, director of laboratories, Bellevue and Allied Hospitals, sent me a section from the tip of Meckel's diverticulum. This contained pancreatic tissue (Fig. 5). Dr. Symmers' letter is as follows: "I am sending to you under separate cover a section of an accessory pancreas removed from the tip of a Meckel's diverticulum of the small intestine, lying about 30 centimeters above the ileocæcal valve. The diverticulum measured about 6 centimeters in length. The accessory pancreas lay at the extreme free end and was about the size of one's little finger nail. On section it presented the typical naked-eye appearance of pancreatic tissue and on microscopic examination you will observe that, in addition to ducts and acini, there are several islands of Langerhans. There are also several small nests of ganglion cells in the interstitial tissues of the gut."

Fig. 6. Meckel's diverticulum with a pin embedded in its wall and with the omentum densely adherent to the tip of the diverticulum.

C. H. I. No. 27137. The specimen contracted markedly after removal. At the time of operation Meckel's diverticulum was of a uniform caliber for its entire length. In the upper picture it can be seen that the omentum has blended with the tip of the diverticulum. At this point all omental fat had disappeared. In the lower picture the pin is seen firmly embedded in the wall of the diverticulum. It was near the free point of the pin that the omentum had become so adherent.

Meckel's Diverticulum Containing an Ordinary pin with its Head Buried in the Wall of the Diverticulum Near its Tip and its Point in the Peritoneal Cavity Free in the Lumen.

C. H. I. No. 31457. Frank C., age 21, was sent to the Church Home and Infirmary by his physician, Dr. A. H. A. Mayer, on November 5, 1921. On November 4 this patient had a temperature of 99°. On the afternoon of the next day it was 101°, but by evening it had dropped to 99°.

His leucocyte count was 50,000. He had definite pain beneath the costal margin on the right. A ruptured duodenal ulcer or an acute gall bladder was at once suspected. The patient also had a definite friction rub over the lower right chest.

He was at once removed to the operating room

and a right rectus incision was made. The liver extended down as far as the umbilicus, the gall bladder was normal, and the duodenum showed no change

The appendix was drawn up and removed through the right rectus incision. It was much enlarged, injected, and presented the characteristic picture of an acute inflammation.

When an attempt was made to pull the omentum up, it was found intimately blended with what appeared to be a straight piece of bowel, in other words, a piece of intestine with no return loop. It was at once recognized as a Meckel's diverticulum. The omentum had grown fast to its entire tip, and at this point consisted almost entirely of fibrous tissue, being here practically devoid of fat.

A gridiron incision was made and the diverticulum drawn out through it and removed. The diverticulum was cut away close to the lumen of the bowel. The intestinal wall was closed with a through-and-through continuous mattress suture of catgut and then with a continuous black silk suture. Great care was taken not to narrow the lumen of the bowel. Nevertheless, when the opening was closed, the lumen at this point was only two-thirds its natural size. I debated for some time whether to do a lateral anastomosis, but thought the bowel would surely take care of itself.

After operation the temperature still remained high, and from time to time the abdomen would become markedly distended. There was also a good deal of fæcal vomiting. The stomach was washed out every few hours, and frequent enemata were given. Finally, the fæcal vomiting stopped, but the marked distention still persisted. Dr. Thomas R. Boggs, who saw him with Dr. Mayer at this time, found definite signs of pneumonia at the angle of the scapula on the left side.

The abdominal distention became intense and on November 12 I made an enterostomy. We had no choice but were forced to take the first loop of distended small bowel that presented. It was evidently high up as the abdominal wall had been much excoriated. From this time on the patient's general condition has improved. Later on we closed the fistula. The patient is now perfectly well.

In future, after removing the diverticulum, if there is any appreciable narrowing of the bowel I shall make a lateral anastomosis, throwing the area of bowel with the stump of the diverticulum out of circuit.

Figure 6 shows a pin embedded in the wall of the diverticulum, also the densely adherent omentum.

The Association of Malignant Myomata with Meckel's Diverticulum

On April 15, 1919, Dr. Douglas Symmers, director of laboratories of the Bellevue and Allied Hospitals, sent me slides from a tumor removed from a man, 22 years old. This tumor had given rise to no symptoms and was accidentally discovered by Dr. Sweeny during an operation for hernia. The tumor was attached to the small intestine about 30 centimeters from the ileocæcal valve. Symmers said that the naked-eye appearances were those of a malignant tumor springing from the base of what appeared to be a Meckel's diverticulum.

Histologically, it suggested a myoma of the uterus undergoing sarcomatous transformation.

Symmers reported this case in the summer of 1919.[1]

He says: "For purposes of description, the specimen is divisible into two parts—an upper, rounded, and elastic to the touch, and a lower solid portion. On opening the upper part, it was found to consist of a pouch-like formation, lined on the inner side by a roughened, dirty-brownish, apparently structureless membrane. The lower portion consisted of a firm, whitish or cream-colored, irregularly lobulated growth, which completely encircled the base of the pouch-like dilatation by which it was surmounted, lobular prolongations from the growth extending upward into the walls of the diverticulum and gradually disappearing therein. On opening the mass, it was found that the walls of the diverticulum merged imperceptibly into a cuff-like tube, the lining of which was thrown into small transverse folds of apparently well-preserved mucous membrane. Projecting into the lumen of this portion of the intestine was a large, pale, firm, whitish tumor, covering the surface of which was a delicate membrane continuous with and presenting the same naked-eye appearances as the cuff of intestine by which the projection was surrounded. Externally the loop of intestine was reinforced by an irregularly lobulated growth, which, on section, presented a smooth, pale surface, where, at intervals, were reddish specks corresponding to injected blood sinuses."

An excellent picture of the gross appearance of the tumor accompanied Symmers' article.

Symmers further says, "I have been able to find but one case of like origin in the literature of medicine, that is to say, a malignant myoma or so-called myosarcoma of Meckel's diverticulum." He then cites the case observed by Kaufmann.

Symmers' conclusions are so instructive

[1] Douglas Symmers. The association of malignant myomata with Meckel's diverticulum. Am. Surg., 1919, August, 181.

that I quote them in detail from the *Annals of Surgery*.

"1. Subserous, occasionally submucous, leiomyomata are encountered in the walls of the stomach, intestine, or gall bladder, in less than 1 per cent of autopsies. As a rule, they are solitary, rarely multiple. Seldom do they exceed a centimeter in diameter.

"2. Judging from the small number of cases to be found in the literature of malignant myomata of the stomach, intestine, and gall bladder, and comparing this with the number of subserous or submucous leiomyomata met with in corresponding situations in the routine performance of autopsies, the assumption seems reasonably justified that these apparently insignificant growths undergo transformation into malignant myomata with a degree of frequency which entitles them to attention as a potential source of danger. If accidentally encountered at operation, they should, I think, be removed.

"3. The majority of malignant myomata of the stomach, intestines, and gall bladder thus far reported were found in organs which otherwise appeared to be intact. In other and rare instances, however, these malignant growths bear a definite anatomical relationship to the developmental malformation of the intestine familiarly known as Meckel's diverticulum.

"4. The malignant myomata of the stomach, gall bladder, and intestine, including those associated with Meckel's diverticulum, are capable not only of extensive local expansion, but of widespread metastasis. Their degree of malignancy is apparently in excess of their prototype, the malignant myomata developing from smooth muscle tumors of the uterus."

UMBILICAL CONCRETIONS ASSOCIATED WITH INFLAMMATORY CHANGES IN THE ABDOMINAL WALL [1]

Many cases of umbilical infection owe their origin to an accumulation of foreign material in the umbilical depression. This causes irritation, the walls of the umbilicus swell and the umbilical opening then may apparently be of pin-point size. The clinical manifestations may, as in the following case, simulate an intra-abdominal lesion, whereas the process is extra-abdominal and limited to the umbilical area.

When an umbilical concretion is the cause of the trouble, it is merely necessary to dilate the umbilicus, curette away the concretion, remove any granulation tissue that may exist, and then treat the umbilical area as one would any other superficial infection. Umbilical infections form a most instructive group. In most cases concretions are responsible for the condition

[1] Disease of the Umbilicus, p.

Case No. [illegible]. W. D., age [illegible], was admitted to The Johns Hopkins Hospital, January 6, 1916, complaining of an infection of the umbilicus and of pain in the lower abdomen.

Five years previously she had begun to have attacks of pain in the left lower quadrant. These would last for three or four days and were associated with some soreness and swelling in that region.

In January, 1913, the patient had a severe fall and injured her left side. The pain then grew worse and in August of the same year was present in both the right and left lower abdomen.

On August 15, 1913, she had [illegible] appendicitis and on the following day experienced a burning sensation to the left of the navel which, after two days, became associated with some swelling at this point. The swelling at first was smooth, but in a few days became soft and fluctuant in the center, while around the softened area was a ring of hard indurated tissue. The lump to the left of the umbilicus became larger and on October 23 it ruptured, discharging a small amount of blood into the umbilical depression. Blood oozed out for two weeks. A week later the skin began to burn and sting and for the next 3 weeks there was a bloody and purulent discharge from the umbilicus.

At the end of this time the swelling began to spread, and the umbilical region over an area as large as a saucer was indurated and discharged pus continuously. There was some fever. The pus gradually became thick and greenish. The discharge was of this character when the patient entered the hospital and for several weeks she had had chills and fever.

On her admission to the hospital an ulcerated area 5 centimeters in diameter was found at the umbilicus. This presented a crusty, reddish-yellow, scab-like appearance and entirely obliterated the normal umbilicus. Surrounding this was a zone of induration. The abdomen was everywhere tender especially in the right lower quadrant. The outlet was normal, the cervix small, the uterus larger than normal, and in retroposition. The fornices were clear. The white blood count was [illegible], hæmoglobin 85 per cent.

Operation, January [illegible]. Under nitrous oxide anæsthesia I dilated the infected umbilicus with a Kelly clamp and a small amount of infected tissue was removed. The wound was dressed twice a day with iodine, and on January 23 alcohol sponges were applied. At this time there was no induration of the abdominal wall.

Second operation, February [illegible]. The cervix was dilated, the uterus was brought into position, and the appendix was removed.

When the patient left the hospital on March 10, 1916, the umbilicus had the normal appearance but the surrounding skin was still somewhat discolored.

Gyn.-Path. No. 21812. The specimen consists of three small pieces of tissue removed from the umbilicus.

Histological examination. Bathing the umbilical cavity was purulent material, beneath which was a thin layer of granulation tissue containing young connective-tissue cells and polymorphonuclear leucocytes. Few capillaries were noted. This granulation tissue extended down for a short distance into the fibrous tissue as slender strands.

It will be noted that in this case we merely dilated the umbilicus and curetted away some inflammatory tissue. The chief thing was the stretching of the constricted umbilical opening so that the discharge could escape.

The subsequent abdominal operation revealed the fact that the inflammatory process had been confined entirely to the abdominal wall, the center of intensity being at the umbilicus itself.

A TUBERCULOUS ABSCESS OPENING AT THE UMBILICUS

Elsewhere I have described the subumbilical space[1] and referred to abscesses that may develop in this situation.

The following case suggested somewhat an ordinary abscess at this point, but the history and subsequent findings clearly indicate that the tubercle bacillus was at the bottom of the trouble. There was later probably a mixed infection.

I have reviewed the literature on tuberculous peritonitis followed by fæcal fistula at the umbilicus,[2] but in the accompanying case there was no escape of fæcal matter, and we were greatly surprised to find tuberculous peritonitis at operation.

We shall naturally find a tuberculous umbilical fæcal fistula only in the late stages of tuberculous peritonitis and then only when the intestine is extensively involved and has become adherent at the navel.

Gyn. No. 25386. G. T., age 25, was admitted to The Johns Hopkins Hospital on October 17, 1919, complaining of a discharge from the navel.

She became pregnant in May, 1918, and got along nicely until January, 1919, when she had pain in the right lower abdomen. She was delivered in February and nursed her baby for a while. She had some fever, occasional night sweats and felt bad.

On February 20, 1919, some swelling of the abdomen was noted and on March 6 an umbilical abscess ruptured.

When the patient entered the hospital there was slight abdominal distention, and exuding from the umbilicus was a greenish-grey, foul-smelling pus. Two inches above the umbilicus was an area of induration 4 centimeters in diameter. Pressure on this caused pus to escape from the umbilicus.

Operation, October 20, 1919. With a pair of Kelly forceps in the umbilical sinus as a guide I made an incision downward toward the symphysis, opening up an abscess cavity 6 centimeters wide and 3 centimeters deep. This cavity was packed with iodoform gauze and the abdominal incision partially brought together. The drainage gradually decreased and the cavity was from time to time irrigated with Dakin's solution. When she left the hospital on November 12, 1919, there was still induration around the umbilicus, and a profuse discharge.

From time to time the patient returned for dilatation of the sinus.

Gyn. No. 25666. The patient was readmitted on January 27, 1920. At this time there was a seropurulent discharge from the umbilicus, and thickening could be made out in the right vaginal fornix.

Operation, February 2, 1920. I excised the umbilical sinus, carefully walled off the intestines, removed the appendix, the tubes, and the left ovary.

Path. No. 25714. The appendix showed chronic inflammation. The fistulous tract was tuberculous. There was also tuberculosis of the tubes and of the left ovary. Tubercles were also scattered throughout the abdomen.

PROBABLE PSORIASIS OF THE UMBILICUS

This patient had a patch resembling psoriasis on his forehead and a similar area on the umbilicus. There is no reason why the navel should be exempt from psoriasis, if there are lesions elsewhere, but we have never noted it in this location before. This patient had appendicitis, and, as he was bothered by the umbilical discharge, we removed the umbilical area at the same time.

Mr. C. P. K., age 40, was referred to me by Dr. Charles L. Warner and admitted to the Church Home and Infirmary March 4, 1921. He had definite symptoms of chronic appendicitis and also complained of a periodic discharge from the navel.

On examination I found a reddening around the edge of the umbilicus particularly in the lower portion over an area 1 centimeter long and 1.5 centimeters broad (Fig. 7). It was thought that this reddened area might in some way be associated with a patch of psoriasis that the patient had on the forehead just at the junction of the hair.

Operation. We removed the umbilicus and found

the peritoneal surface at this point perfectly smooth. The appendix was removed and the small bowel carefully examined to see if by chance a Meckel's diverticulum existed.

Gyn.-Path. No. 26644. Sections from the outlying portions of the umbilicus show normal epithelium. As we approach the reddened area, the papillæ become longer, in some places reaching the surface, and at a few points project right through the epithelial covering. In the neighborhood of such points the epithelium, which appears horny and shows slight infiltration with small round cells, may be piled up as little elevations. The stroma immediately beneath the squamous epithelium in these areas is in places rarefied. There are young capillaries in such areas and they are surrounded by small round cells. In other places there are large aggregations of these small round cells in the stroma just beneath the epithelium.

Fig. . Photomicrograph of [illegible]

Gyn. Path. No. [illegible] Section [illegible] about half of the [illegible] reddish in color and [illegible] patient's forehead. [illegible] condition on the upper portion of the umbilicus. From the [illegible] of area [illegible] epithelium. The epithelium itself was here and there [illegible] dead epithelium. The stroma just beneath the epithelium, [illegible] cell infiltration.

It is quite possible that the red area at the umbilicus was identical with that noted on the forehead just at the junction of the hair. The clinical diagnosis of the area of redness on the forehead was psoriasis.

SYPHILITIC CONDYLOMA OF THE UMBILICUS

Syphilis of the umbilicus is rare. It is divided into two groups:

Syphilis of the umbilicus at or shortly after birth, and syphilis of the umbilicus in the adult.

One of the most interesting cases of syphilis of the umbilicus in the adult ever noted was the one observed by Fiaschi, of Sydney, Australia. I have described this case in detail elsewhere.[1] In addition to the primary chancre on the prepuce was a chancre at the umbilicus. The photograph of the umbilicus showed several dome-like elevations projecting from the floor of the navel, and trickling down the abdomen from the navel was a watery fluid. Spirochætæ were obtained from the umbilicus.

In November, 1916, I saw an interesting case of syphilitic condyloma of the umbilicus, with Dr. A. G. Rytina at the Mercy Hospital, Baltimore. The history, as given by Dr. Rytina, is as follows:

"November 16, 1916. F. F., white, male, steel worker, complains of sores around anus. He has been in good health all his life. No previous venereal diseases, except a sore on penis 8 weeks ago, the

[illegible]

A. G. Rytina, Consultant [illegible] Am. J. [illegible] 1915, p. [illegible]

incubation period of which [illegible] He was healed in a month under local treatment.

"Present condition. About 5 weeks ago the patient noticed a severe itching around the anus. This was followed in several days by the appearance of a number of sores which gradually became larger and more painful. During the past 2 weeks a [illegible] mass has appeared around the anus. It is so painful and uncomfortable that the patient has no rest. During the past day or two the patient has had a burning and itching sensation in the umbilical region. This he attributes to an elastic belt which he wore and which rose to the level of the navel. He also complains of a sore throat and a sore on the inside of the lower lip.

"Examination reveals the external genitals normal, except for the presence of a small elevation on the right lip of meatus, and an indurated area on the left side of the penis near the frenum. Both these places are the remains of the original [illegible] infection, which were evidently two in number. No examination of these for spirochætæ pallidæ has been made before they healed. The inguinal glands of both sides are enlarged and painless. Surrounding the anus there is a ring of condylomata, which on microscopic examination show many spirochætæ pallidæ. A [illegible] rash is seen over the body. The right tonsil is covered by a mucous patch, and [illegible] of lower lip. A [illegible] is present.

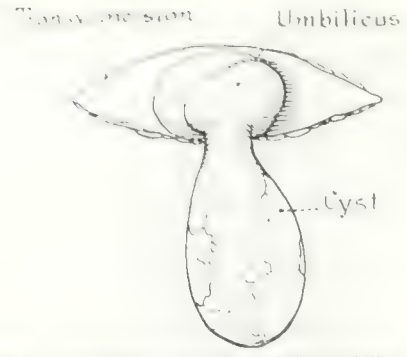

Fig. 8.—An atheromatous cyst of the umbilicus.

This is a copy of the sketch made by Dr. Edwin Dargan Smith of Louisville, Kentucky, prior to his removal of the umbilical cyst. It was pear-shaped, measured 2 by 3 centimeters and was pedunculated. The overlying skin was thinned out and had branching blood vessels scattered over its surface. The cyst was filled with a pasty, pale, granular, and rather dry, material.

"Inspection of the umbilicus shows a slightly reddened area around it. On everting the umbilicus, three distinct, typical condylomata are seen. Microscopic examination shows many spirochætæ pallidæ.

"Treatment. The patient was given four intravenous injections of salvarsan of 0.3 gram each, at weekly intervals. On December 4 there was slight itching around the anus, but the pain had disappeared. The condylomata of the umbilicus were drying up. On December 12 the condylomata of the anus were almost dried up and no longer caused discomfort. The condylomata of umbilicus were dry and smaller. At present lesions have all cleared up."

Dr. Rytina, in summing up the essential points in the case, says: "The most interesting feature of the case is the wearing of the belt around the umbilicus, the irritant action of which was undoubtedly the predisposing factor in the production of the lesion. The diagnosis of the lesion was easily made by its typicalness, being exactly similar to the condylomata ani, which the patient also had. The certainty of its luetic nature was demonstrated by the presence of the spirochæta pallida and its rapid disappearance after the institution of antisyphilitic treatment."

BLUISH DISCOLORATION OF THE UMBILICUS AS A DIAGNOSTIC SIGN IN RUPTURED EXTRA-UTERINE PREGNANCY

In 1919[1] I reported, and Max Broedel illustrated, a new sign that may prove of value in the diagnosis of some tubal pregnancies where the abdomen contains an abundant quantity of free blood. If the hæmorrhage has been a sharp and severe one, the clinical symptoms are so evident that operation is at once undertaken. But occasionally the bleeding has evidently been slow but persistent. In such cases the abdomen may accumulate a large quantity of blood without the patient having given any evidence of shock.

In such a case the umbilicus may in some manner imbibe the blood and appear bluish black, so that in time we get the same play of colors at the umbilicus that one does with a black eye—the greens and yellows.

On March 21, 1918, there entered the Church Home and Infirmary a thin wiry woman (C. H. I. 18744), who looked to be nearly 60 years of age but who was actually only 38. She was the mother of seven children. For 3 weeks she had had pain in the right lower abdomen with intermittent attacks of abdominal distention. One week after the onset of the trouble the umbilical region suddenly became bluish black, although there had been no injury in this region. Pelvic examination was very unsatisfactory on account of the marked abdominal distention.

Operation, March 27, 1918. With the patient asleep the uterus was found to be slightly enlarged. To the right of the uterus was a freely movable mass, about 8 centimeters long by 5 centimeters broad.

Prior to opening the abdomen I dictated the following note: "The bluish-black appearance at the navel unassociated with any history of injury, together with the mass to the right of the uterus, makes the diagnosis of extra-uterine pregnancy relatively certain, although the patient has not missed any period and although there has been no uterine bleeding."

On opening the abdomen I found it filled with dark blood and attached to the fimbriated end of the right tube was an extra-uterine pregnancy. It was possible to remove this without sacrificing the tube.

The bluish discoloration gradually diminished in intensity during the patient's sojourn in the hospital prior to operation, and disappeared completely within a few days after operation. The gradual change in color that took place in the umbilical region reminded one strikingly of the changes in color that occur in a black eye resulting from a blow.

I recorded this case in order that subsequent ruptured extra-uterine pregnancies may be examined for this sign. Whether it will prove to be of common occurrence or very rare, I cannot say, but we shall naturally expect it only where there is free blood in the

[1] Thomas S. Cullen. Bluish discoloration of the umbilicus (Cullen's sign) in ruptured extra-uterine pregnancy. Contributions to Medical and Biological Research, Dedicated to Sir William Osler, [illegible] on the occasion of his fiftieth birthday, July 12, 1919, by his pupils and colleagues.

Fig. [illegible] Vascular Nævus.

C. H. I. No. 20561. Gyn.-Path. No. 24661. This is a section of the small reddish blue nævus seen in Plate I, D. The squamous epithelium is somewhat thinned out. The blood vessels of the nævus are large, have very thin walls, and many of them have little or no intervening stroma.

abdomen, and shall probably be more likely to encounter it in thin individuals.

Dr. Emil Novak, who is associated with me in our laboratory work, has recently had two cases presenting this sign. These he reported in the *Journal of the American Medical Association*, 1922, lxxviii, 643. Recently a similar case has been recorded in the *Centralblatt fuer Gynaekologie*.

ATHEROMATOUS CYSTS OF THE UMBILICUS

In a survey of the literature[1] I noted six genuine instances of atheromatous cysts of the umbilicus. The major portion of those reported seemed to be cases of umbilical infections with concretions and not atheromatous or dermoid cysts.

During the last 5 years I have observed three cases, one at The Johns Hopkins Hospital; Dr. H. H. Hampton, then resident surgeon at the Hebrew Hospital, removed the second; and the specimen of the third case was sent me by Dr. Edwin Dargan Smith, of Louisville, Kentucky. In Dr. Hampton's and also in Dr. Smith's case the condition was noted at or shortly after birth. In our case no mention was made of any umbilical trouble until the patient was 18 years old.

These tumors may spring from the umbilical depression or from the wall of the umbilicus; they are usually pedunculated, may reach three or more centimeters in diameter, are covered with skin, are usually flaccid, are thin-walled, have smooth inner surfaces and are filled with grumous or crumbly material.

They are lined with a more or less well-developed squamous epithelium, and are devoid of hairs and sebaceous and sweat glands.

Histological examination of the cyst contents shows exfoliated squamous epithelium, fat droplets and frequently cholesterin crystals. These cysts are easily removed.

Fig. 1.—Papilloma of the umbilicus.

This photograph together with a slide was sent me by Dr. N. B. Carson of the Barnard Free Skin and Cancer Hospital, of St. Louis, Missouri. St. Louis No. S15165. The entire umbilicus is involved in the papillomatous growth which extends well above the surface of the abdomen. At some points it is wider than at others. The surfaces of the papillary masses were covered by many layers of squamous epithelium, the superficial layers of which were hornified. Here and there between epithelial cells were polymorphonuclear leucocytes, many of them eosinophilic. Immediately beneath the epithelium there was a very active inflammatory reaction, young connective-tissue cells, small round cells and polymorphonuclear leucocytes being present. Beneath this, again, was the characteristic stroma of the part. There was no evidence of malignancy. This is the first specimen of this kind that I have ever seen.

In the Emmett operation for perineal repair a wide removal of the vaginal mucosa is made. Occasionally a small piece of vaginal mucous membrane has been overlooked, and when the parts were approximated this has been carried into the depth of the perineum. This in time may form a small cyst filled with grumous material. I have pictured a vaginal cyst of this character.[1]

Similar cysts undoubtedly occasionally occur where a small loose piece of vaginal mucosa is accidentally buried when the perineal repair is done immediately after labor.

We are thoroughly familiar with the remnants of the omphalomesenteric duct that are not infrequently noted at the navel, and with the gradual closing in of the abdominal walls, finally culminating in the formation of the umbilicus. It is quite possible that a small piece of attenuated skin of the umbilical scar might become buried in this region. This would very naturally in time produce a small atheromatous cyst.

[1] [illegible] Vaginal Cysts. Johns Hopkins Hosp. Bull., [illegible]

An Atheromatous Cyst of the Umbilicus

Gyn. No. 21957. E. T., aged 20, entered The Johns Hopkins Hospital March 20, 1916, complaining of backache and of pain in the lower abdomen. For 2 years she had had occasional attacks of abdominal pain usually near the umbilicus, and radiating to the flanks.

Protruding from the umbilicus was a rounded lobulated, soft tumor about 3 by 1.5 centimeters. This sprang from the umbilical depression and from the abdominal wall directly below it, by a delicate pedicle. Dr. Kelly removed the umbilicus together with the cyst.

Gyn.-Path No. 22003. The specimen consists of an oval piece of skin containing in its center the umbilicus. Arising from the lower margin of the umbilicus by a pedicle 1 centimeter in diameter is a cyst 3.5 centimeters in diameter. This is covered by skin. It contains sebaceous-like material.

Even without a microscopic examination the specimen presents the typical picture of an atheromatous cyst of the umbilicus.

An Atheromatous Cyst of the Umbilicus

On November 1, 1917, M. S., a small boy entered the Hebrew Hospital and came under the care of Dr. H. H. Hampton, who sent me the specimen and the history of the case.

This boy since birth had had a small tumor which hung down from the umbilicus by a well-defined pedicle. The tumor was soft, had a semisolid consistency and apparently had altered little in size for a considerable period.

Operation by Dr. Hampton. The cyst was readily removed. There was apparently no direct connection between it and the peritoneal cavity.

Gyn.-Path. No. 23463. The tumor is whitish in color, is oval, measures 3.4 by 2.7 by 1.7 centimeters and is definitely cystic. Its walls vary from 0.5 to 1 millimeter in thickness. When a small hole was made in it, a sebaceous-like material escaped.

No perfectly satisfactory sections of the cyst could be obtained, as the tissue was very brittle and did not cut well. The walls were composed of connective tissue, poor in nuclei. The inner surface of the cyst was lined with an imperfect squamous epithelium. The deep layer was cuboidal, and superimposed on it were five or six layers of ill-defined squamous epithelial cells.

The growth was evidently an atheromatous cyst.

An Atheromatous Cyst of the Umbilicus

Dr. Edwin Dargan Smith of Louisville, Kentucky, on November 21, 1918, sent me a

report of an interesting umbilical cyst he had recently removed, together with portions of the specimen.

The patient, a school boy of 11, came under Dr. Smith's care on November 7, 1918. A few weeks after birth a small growth appeared at the umbilicus. The tumor grew only slowly until six years ago but after that gradually increased in size. It was covered with skin, had the consistency of a lipoma, was pear-shaped, measured approximately 2 by 3 centimeters and was attached to the umbilicus by a pedicle measuring about 3 by 8 millimeters. The overlying skin was thinned out, had small branching blood vessels scattered through it and would slide readily over the growth (Fig. 8). There was no pain referable to the umbilicus.

Operation, November 8, 1918. A transverse incision was made embracing the umbilicus, as in the Mayo operation, and the umbilicus removed. The inner surface of the navel was perfectly smooth. The appendix was removed, and a slight physiological intussusception was easily reduced. The boy was discharged November 17.

Dr. Stuart Graves, pathologist of the Louisville City Hospital, found that the cyst contained a cavity, 1 centimeter in diameter. It was filled with a pasty, pale, granular, and rather dry material. This material under the high power was found to be crystalline in nature. It dissolved in a mixture of absolute alcohol and ether. Dr. Graves found it impossible to get satisfactory sections of the cyst wall, and we had the same trouble.

The cyst was lined with what looked like an embryonic epithelium apparently of the squamous cell type. In some places this was two or more layers in thickness. The nuclei were oval and vesicular, but the individual cells were not well differentiated. At other points, there was a well-defined squamous epithelium, several layers thick, and covering the surface of this was what appeared to be an ill-defined horny epithelium.

Undoubtedly this was a small atheromatous cyst of the navel.

ADENOMYOMA OF THE UMBILICUS

Adenomyoma of the umbilicus is a definite clinical entity. Elsewhere[1] I have considered the subject fully and have discussed the literature.

These growths naturally occur only in women. They are small, occasionally swell up at the menstrual period and sometimes cause a slight escape of blood from the umbilicus during the period.

Histologically, they consist of non-striped muscle and fibrous tissue with uterine mucosa

[1] Diseases of the Umbilicus, p. 373.

Fig. 11. Small pr[illegible] secondary to a large pseudomucinous cyst of the ovary.

C. H. I. No. 19252. Gyn.-Path. No. 24072. Occupying the upper part [illegible] cyst. The umbilicus and the large ovarian cyst and the free pseudomucinous fluid in the abdominal cavity removed.

scattered here and there throughout the nodule.

Recently two further cases have come under my notice. These were published in detail in the *Archives of Surgery*, 1920, vol. i, 270.

SMALL NEVUS OR HEMANGIOMA OF THE UMBILICUS

Small nævi of the skin are relatively common, but in only one instance have I ever noticed a nævus at the umbilicus. Histologically, it was similar to those found in the skin. Under ordinary circumstances no attention would have been paid to it, but the patient worried about its presence, and as he had some discharge from the umbilicus we removed the entire umbilical area.

C. H. I. No. 20561. H. E. S., 50 years of age, was admitted to the Church Home and Infirmary early in January, 1919. He was perfectly well, except that he complained of some discharge from the navel. The umbilical mamelon projected somewhat and springing from its surface was a small bluish red nodule about 3 millimeters in diameter (Plate I, D). This seemed to be [illegible]

Operation, January [illegible], 1919. As the umbilical discharge worried the patient considerably, we thought it wiser to remove the area. This was done. The wound healed by [illegible]

Gyn.-Path. No. 24661. The squamous epithelium over the small, bluish red mass is only two or three layers in thickness. Immediately beneath

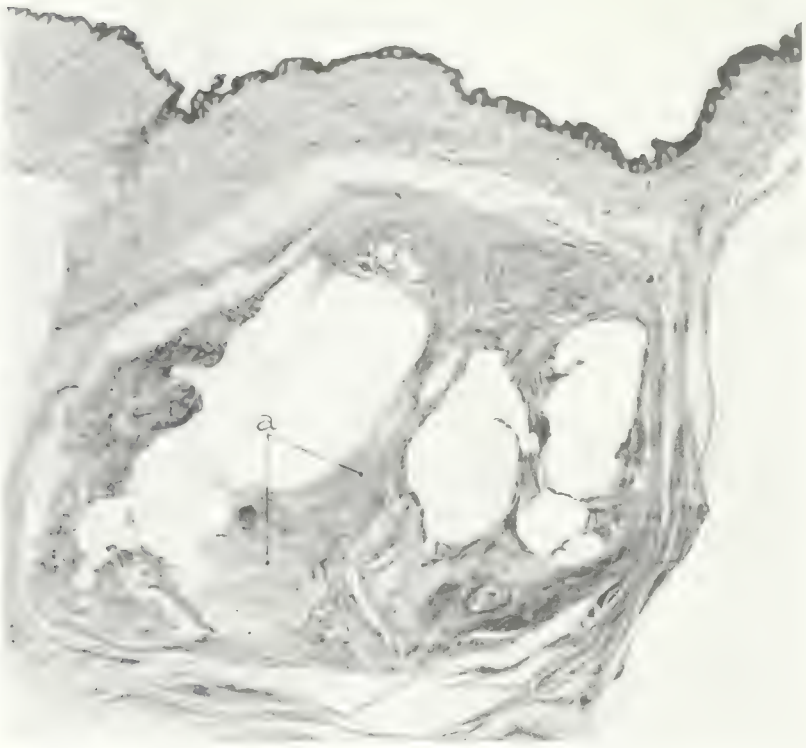

Fig. 12. Small pseudomucinous cysts at the umbilicus, secondary to a large pseudomucinous cyst of the ovary.

C. H. I. No. 19252. Gyn.-Path. No. 24072. The squamous epithelium at the umbilicus is unaltered. Below this is an irregular, spherical area made up of small cysts. Lining a few of these was an ill-defined epithelium, and in the surrounding fibrous tissue were bluish areas where small glands had formerly existed. Most of the epithelium has melted away into pseudomucinous fluid. Coagulated pseudomucinous fluid is well seen at *a*. For the gross appearance of the umbilicus at operation see Figure 11.

this is a narrow zone of fibrous tissue, beneath this again are large quantities of blood vessels lined with one layer of endothelium, and often lying one against the other with no intervening stroma (Fig. 9). If the blood were removed, the spaces with the delicate intervening stroma would bear a striking resemblance to lung tissue. The line of demarcation between the blood vessels and the underlying fibrous tissue is sharply defined.

The picture is that of an angioma. Clinically, it is of little significance. Histologically it is very interesting.

MOLES OF THE UMBILICUS

On one or two occasions I have noted small pigmented moles in the umbilical depression, or along its side. Dr. Leo Brady, resident gynecologist, Johns Hopkins Hospital, has also noted them. They have occasioned no trouble.

PAPILLOMA OF THE UMBILICUS

The literature on this subject I have collected and published in my *Diseases of the Umbilicus*, p. 360.

On September 20, 1916, Dr. N. B. Carson of the Barnard Free Skin and Cancer Hospital, St. Louis, Missouri, sent me a photograph and slides of a papilloma of the umbilicus. This case was published in the *Annals of Surgery*, February, 1917, p. 199.

The patient A. C., male, white, age 77, was admitted to the hospital on October 25, 1915. He had always done outdoor work, gave no history of lues, and, apart from one attack of jaundice several years before, had always been in good health.

About a year before admission the patient noticed a small mass the size of a "dime" at the umbilicus. There had been no history of injury. The mass

never ulcerated and occasioned little pain. Recently it had increased in size.

On admission the picture presented in Figure 10 was found. At the umbilicus was a hard irregular indurated mass surrounding the umbilical opening. There was no ulceration. The growth appeared to extend deeply, but did not seem to invade the surrounding tissue. Dr. Carson said that there was no evidence of hernia nor of any abdominal masses. The liver was about four fingers' breadth below the costal margin. Examination of the rectum was negative.

Operation. Under 1 per cent novocaine, an elliptical incision, about 5 centimeters in length including the tumor, was made across the abdomen, and carried down to the peritoneum. The tumor did not extend into the abdomen, but seemed to be limited to the umbilicus. The omentum was, however, adherent at this point. Exploration of the abdomen failed to reveal anything abnormal.

The patient made an uneventful recovery.

Dr. Carson said: "The tissue consists of an elliptical piece of skin 4 by 8 centimeters, which surrounds a papillomatous growth, 2 by 2 centimeters. The surface of the growth is irregular and ulcerated, and the growth extends down along the umbilical tract. It seems to be fairly well encapsulated. It does not seem to invade the surrounding tissue."

On examination of the slides kindly sent to me by Dr. Carson I found that the growth was a papilloma. The papillary masses were everywhere covered over by many layers of squamous epithelium, the superficial portions of which were horny. Scattered here and there between the epithelial cells were small round cells or polymorphonuclear leucocytes, many of which were eosinophiles. The connective tissue immediately beneath the epithelium showed a very active inflammatory reaction, young connective-tissue cells, small round cells, and polymorphonuclear leucocytes being present. The central stems of the papillary masses consisted of fibrous tissue.

The picture is that of a typical papilloma springing from the squamous epithelium.

SMALL UMBILICAL CYSTS SECONDARY TO A PSEUDOMUCINOUS CYST OF THE OVARY

By some pseudomucinous cysts of the ovary are looked upon as benign, by others as malignant. I think if we take a position midway between these two views we shall be nearer the mark.

When we follow the clinical course of these cases, we note that in some there is a rapid return of the growth, in others, years may elapse before a second operation is necessary.

In the following case, at the time of operation, several small pseudomucinous cysts were found at the umbilicus. Histologically,

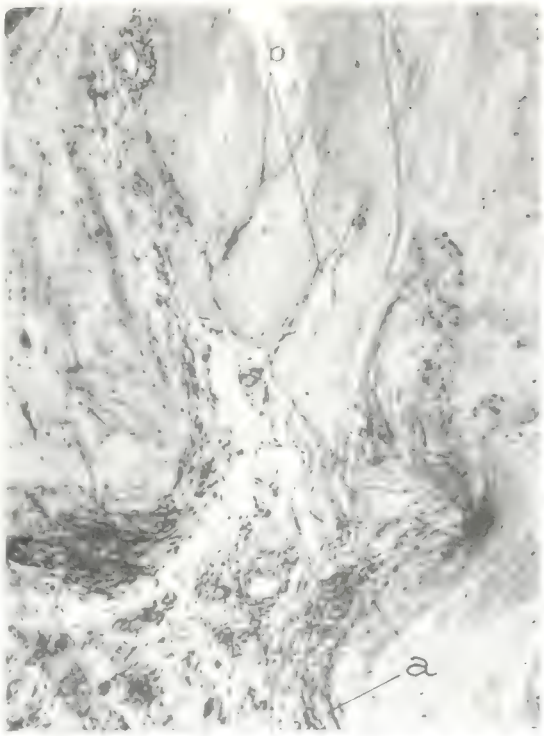

Fig. 10. [illegible]
C. H. I. No. [illegible] wall containing numerous small [illegible]

these were identical in [illegible] with the large ovarian tumor.

This is the only instance, so far as I know, where a pseudomucinous cyst of the ovary was accompanied by umbilical cysts of the same type. They were, of course, secondary.

C. H. I., No. 19252 Mrs. M. D. of Knoxville, Tennessee, [illegible] May, 1915, complaining of marked abdominal enlargement.

She had [illegible] had had [illegible] Her menses had ceased suddenly at the time of the Baltimore fire, [illegible] years previously. She was [illegible] time. In 1900 she had had peritonitis and was ill [illegible] weeks.

Her abdominal enlargement dated back about 2 months. She had had [illegible] bronchitis. The abdomen was uniformly and markedly distended and there was a most unusual picture at the navel (Fig. 11). The upper part of the umbilical

Fig. [illegible]. Epithelioma of the umbilicus emanating from an extensive atrophic scar following a severe roentgen-ray burn. (After Heidingsfeld.)

ries had been replaced by a small cyst, on the top of which was a second cyst, and projecting from the umbilical depression there appeared to be a third cyst.

Pelvic examination was unsatisfactory, as the abdominal growth seemed to have pulled the pelvic structures up into the abdomen.

Operation, June 4, 1918. On opening the abdomen we found quantities of free colloid material. This was removed as far as feasible. We then took away a large pseudomucinous cyst of the right ovary. The appendix was twice the natural size and also thickened.

The peritoneal surface of the umbilicus was perfectly smooth. The patient's recovery was uneventful.

May 2, 1921. Mrs. D. came to see me today—'dropped in to let me see how well she was.' For some time after operation she had pain in the gall-bladder region. At present she has no discomfort at all, feels perfectly well, does her own washing and ironing and looks the picture of health.

The specimen consists of a large mass of material which has evidently been an ovarian cyst. This has apparently ruptured before operation. It is made up chiefly of large cystic cavities filled with gelatinous-like material. In some of the cysts this material is dark reddish brown in color, in others grayish brown, and in some the cyst content is yellowish white. The entire picture suggests a pseudomucinous ovarian cyst of large proportions.

The umbilicus contains several small cysts as indicated by Figures 11 and 12.

Gyn.-Path. No. 24072. The cyst was in some places lined with a low epithelium (Fig. 13 at *a*), but at most points this had melted away and we had a material that stained rather bluish with hæmatoxylin. The picture was that of a typical pseudomucinous cyst. At the umbilicus the small cysts were similar in character (Fig. 12), and one sees in the connective tissue little bluish areas where all trace of the epithelium has already disappeared. The general picture is that of a typical pseudomucinous cyst.

CARCINOMA OF THE UMBILICUS

In my *Diseases of the Umbilicus*, p. 400, carcinoma of the umbilicus was fully considered and abstracts of the more important cases were given. As a result of the analysis I made the following classification:

A. Primary umbilical carcinoma: (1) squamous-cell carcinoma; (2) adenocarcinoma.

B. Secondary umbilical carcinoma: (1) from the stomach; (2) from the gall bladder; (3) from the intestine; (4) from the ovaries; (5) from the uterus; (6) from other abdominal organs.

Primary Squamous Cell Carcinoma of the Umbilicus

Primary squamous-cell carcinoma of the umbilicus is very rare. In my book (p. 402) are recorded three cases from the literature that might possibly belong to this group.

Heidingsfeld[1], professor of dermatology in the University of Cincinnati, in a very interesting article entitled "Etiologic Rôle of Scar Tissue in Skin Cancer" gives a good picture of an epithelioma of the umbilicus, in the center of an extensive atrophic scar following a severe roentgen-ray burn.

Carcinoma of the Umbilicus Secondary to Carcinoma of the Stomach

From a study of the literature[2] it is evident that, where secondary carcinoma of the umbilicus develops, the primary growth has been most frequently noted in the stomach.

On November 13, 1917, Dr. Frank Warner, of Columbus, Ohio, wrote me saying that he had just seen a case of carcinoma of the pylorus with a secondary growth at the navel.

The patient was a man 54 years old. Nineteen years before he had had symptoms indicating gastric ulcer. For 6 months before admission he had had gastric symptoms. At the time of his admission to the hospital there was a hard, red, firm mass at the umbilicus. This was tender on pressure. It had not ulcerated. At the pyloric end of the stomach was a large hard mass, not very freely movable.

The entire umbilicus was removed, but the stomach growth was too extensive to permit of a radical operation.

The umbilical growth was an adenocarcinoma

[1] J. Am. M. Ass., 1[illegible] Nov. 15, 1913. I have taken the liberty of reproducing Heidingsfeld's picture that appeared in the *Journal of the American Medical Association*.

[2] Diseases of the Umbilicus, p. [illegible].

Fig. 15. Adenocarcinoma of the umbilicus, probably secondary.

Gyn.-Path. No. 25172. Specimen sent by Dr. Donald Guthrie of Sayre, Pennsylvania. The umbilical margins are raised and in the central portion was some ulceration. The drawing to the right shows that the peritoneal surface was smooth, but that a small vessel passed from that point. The lower picture shows the apparent fibrous character of the umbilical depression. From this one would hardly think that a carcinoma existed. On microscopic examination it was found that the squamous epithelium in the umbilical depression had at some points disappeared and that the surface was covered with polymorphonuclear leucocytes. The growth was an adenocarcinoma, with areas suggesting colloid. Whether it was primary or secondary is not absolutely clear.

undoubtedly secondary to the carcinoma of the pylorus.

The case is reported in detail elsewhere.[1]

Carcinoma of the Umbilicus Secondary to Carcinoma of the Intestine

Carcinoma of the umbilicus secondary to malignant growths in the intestine is rare (see *Diseases of the Umbilicus*, p. 425).

On September 25, 1916, I received the following letter from Dr. M. G. Wohl, pathologist of the Nicholas Senn Hospital. "I am sending you under separate cover two slides from an umbilical malignant growth. Will you be kind enough to express your opinion upon them?

The history of the case is as follows:

"Mrs. C., age 60 years. She had always enjoyed good health. For the past 6 months she had noticed a lump in the umbilical region. This annoyed her but caused no pain.

"Upon examination nothing abnormal was found except a protruding tumor at the umbilicus which was adherent to the underlying tissues.

"Operation disclosed a [illegible] nodule

[1] Frank Warner. Carcinoma of the umbilicus. Surg., Gynec. & Obst., 1913, xxvii, [illegible].

[illegible] surrounding the umbilicus; this had pushed the peritoneum into the abdomen and had entirely displaced the recti muscles. It was firmly adherent to the transverse colon. The tumor was removed together with 8 inches of transverse colon.

"The patient died of peritonitis. No postmortem was obtained, but at operation the stomach was found to be normal. There was, however, a nodule the size of a duck's egg in the sigmoid. It had the appearance of an adenocarcinoma."

My report was as follows:

The sections show adenocarcinoma in some places of a well-defined gland type; in other places the growth is more cellular, there is less stroma and there is a definite tendency for the epithelium to form solid nests.

Whether the primary growth was in the sigmoid or transverse colon cannot be determined with certainty. There was no opportunity to examine the rectal growth. Since then Wohl[1] has reported the case.

Carcinoma of the Umbilicus Secondary to Carcinoma of the Rectum

Carcinoma of the umbilicus following carcinoma of the rectum is rare. Frank Warner, in 1918[2] reported the case of a man of 68, who for a year or more had had occasional attacks of pain and soreness in the rectum, associated with attacks of diarrhœa followed by constipation.

At the umbilicus was a mass 1 inch in diameter. This was hard and fixed to the deeper structures.

At autopsy 2 months later the rectum was found almost occluded by a scirrhous mass.

Microscopic examination showed that the primary growth was in the rectum and that the umbilical tumor was secondary.

The report is well worth a careful reading.

Probably Secondary Carcinoma of the Umbilicus—Primary Source Undetermined

In the accompanying cases the umbilical growth was an undoubted carcinoma, but no opportunity was afforded to determine whether the growth was primary or secondary. As primary adenocarcinoma of the umbilicus is very rare, they are included among the secondary growths.

Adenocarcinoma of the Umbilicus Probably Secondary

On July 2, 1919, I received a letter from Dr. Donald Guthrie of the Robert Packer Hospital, Sayre, Pennsylvania. He had just operated on F. H., a man 69 years of age.

The patient had had soreness in the umbilical region since Christmas, 1918. The hard lump about the umbilicus had grown slowly and there had never been any bleeding, discharge, or pain. For the gross appearance of the umbilicus see Figure 15.

Dr. Guthrie said: "From exploration at the time the abdomen was opened I am satisfied there were no metastases from the liver."

Gyn.-Path No. 25172. The surface of the section is in places covered over by normal skin, at other points this has disappeared, and there is a necrotic growth covering the surface. The superficial portion of this shows marked polymorphonuclear infiltration and the shadows of glands. In the depth is a typical adenocarcinoma, the gland type being particularly well preserved. At some points the gland epithelium tends to melt away and one gets the idea of a colloid growth. In the deeper portions the glands are much larger and the tendency toward colloid is even more marked.

It is impossible to tell where this carcinoma started; it apparently is secondary. The growth is undoubtedly malignant and the outlook is not good.

Adenocarcinoma of the Umbilicus Probably Secondary

Dr. Caroline McGill, on November 29, 1920, sent me an umbilicus from the Murray Hospital, Butte, Montana.

The patient, Mrs. G., 45 years of age, 4 years before, had fallen, striking the abdomen. For 3 months she had felt a small mass at the navel. Two weeks before admission it broke down forming an ulcer. It was unassociated with pain.

When the patient was first seen on November 2, 1920, she had a wide open umbilicus. Her past history was negative except for the fact that for 3 or 4 months she had had polyuria and polydipsia.

The patient was rather obese, had bad teeth, and varicose veins of both legs. The urine contained 2 per cent of sugar. She was put to bed and given a diabetic diet. In 3 days the sugar had disappeared.

Operation by Dr. T. C. Witherspoon. The umbilical ulcer together with a wide area of fat and skin were removed under local anæsthesia. Frozen sections made at the time (Dr. McGill tells me) showed adenocarcinoma. Two weeks after operation the patient was given radium and advised to come back for radium treatment later.

Gyn.-Path. No. 26364. The specimen consists of a small umbilicus together with a good deal of the surrounding adipose tissue. The umbilical depression is 5 millimeters deep. It is rather difficult to determine just what the ulcer was like because the specimen has been in hardening fluid for some time. The tissue immediately beneath the umbilical

[illegible] Wohl, Carcinoma of the umbilicus. Boston M. & S. J., 1917, [illegible].

[illegible] Warner, Carcinoma of the umbilicus. State Univ. Iowa Med. Bull., 1918, [illegible].

depression shows what appears to be an irregular, fibrous transformation. The firm tissue beneath the umbilical depression is at least 1.5 centimeters thick and strands of this fibrous-looking tissue extend into the underlying fat. This is the picture that one usually finds with carcinoma of the umbilicus, and when the tissue is cut into, one would not for a moment get the impression that he was dealing with a carcinoma.

The skin of the umbilicus at the margin of the ulcer shows little or no change. The surface of the ulcer is covered by polymorphonuclear leucocytes and in some places are glands extending right up to the surface. The firm fibrous-looking area at the umbilicus is composed of fibrous tissue with quantities of glands scattered throughout it. Some are small, others rather large; nearly all are lined with one layer of cylindrical epithelium. Where the glands are dilated, some of them are filled with polymorphonuclear leucocytes and the gland epithelium is thinned out, becoming cuboidal or almost flat. In the depth some of the glands are minute. The picture is that of a typical adenocarcinoma. It is probably secondary, as primary adenocarcinoma is exceptional. It is, of course, as yet impossible to tell where the original tumor was.

A Malignant Abdominal Growth with a Secondary Nodule Just Above the Umbilicus

From the appearance at operation it was perfectly clear that the abdominal growth was malignant. Much as we desired to know the exact character of this growth, removal of a piece of the tissue would have added to the risk and consequently we refrained from excising any. The probabilities are that the tumor was carcinomatous. The umbilical growth was undoubtedly secondary to that occupying the abdomen.

C. H. I. No. 16098. Mrs. A. C., age 73, was admitted to the Church Home and Infirmary, late in May, 1917. Her abdomen was markedly distended. On account of dyspnœa it was thought wiser to let her rest in bed for a few days before operation.

Operation, June 2, 1917. Situated just above and slightly to the right of the umbilicus was a hard plaque of tissue, about 3 centimeters in diameter and raised about 2 millimeters above the general surface of the abdomen (Fig. 16). The umbilicus itself was slightly indurated.

The growth in the umbilical region, coupled with the marked abdominal enlargement, at once suggested a malignant abdominal growth with a metastatic tumor at the umbilicus.

We made a very small mid-line incision below the umbilicus and let out quantities of ascitic fluid. The omentum had been converted into a solid mass at least 6 or 8 centimeters thick, and nodules were found scattered throughout the abdomen.

Fig. 16. A malignant abdominal tumor with a secondary growth at the umbilicus.

C. H. I. No. 16098. Mrs. A. C. May, 1917. The abdomen contained much ascitic fluid. The omentum had been converted into a solid mass over 6 centimeters thick. Nodules were found scattered through the abdomen. No attempt was made to locate the original tumor. At the point indicated by the dotted line was a moderately sized raised secondary growth which reached the upper umbilical margin.

We did not attempt to find the original source of the trouble, as we deemed it best to let the patient go home at the earliest possible moment.

SECONDARY SARCOMA OF THE UMBILICUS

Sarcoma of the umbilicus whether primary or secondary is very rare (see *Diseases of the Umbilicus*, p. 449).

The following case is the only one in which I have had the opportunity of examining sections. The growth was a perithelial angiosarcoma (Fig. 17).

On June 14, 1921, Dr. F. C. Warnshuis of Grand Rapids, Michigan, saw Mrs. B., age 45, who for the past 2 years had noticed a peculiar enlargement and hardening of the navel. This was tender at times. The center of the umbilicus was soft and her family physician told her that she had a small umbilical hernia. She wore a truss for a time, but discarded it on account of the pain it occasioned.

About the middle of March, 1921, her abdomen commenced to increase in size and when Dr. Warnshuis saw her, it was markedly enlarged. For the preceding 2 weeks she had had increasing discomfort from the distention, with dyspnœa.

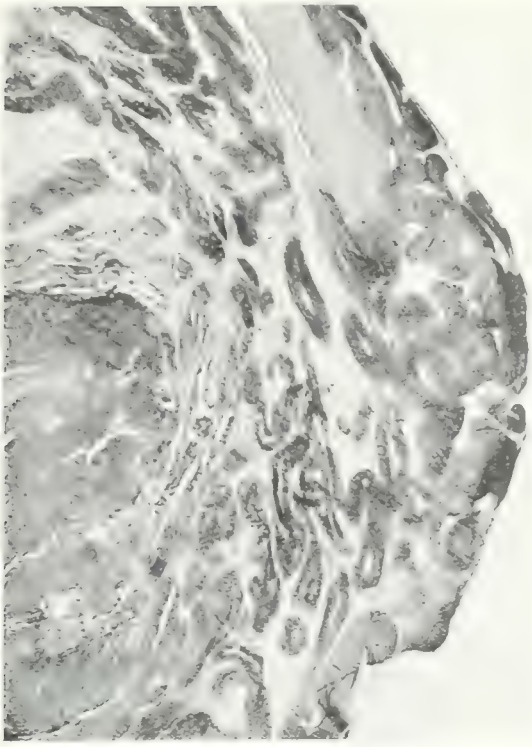

Fig. 17. Secondary sarcoma of the umbilicus.
Specimen sent by Dr. F. C. Warnshuis. Gyn.-Path. No. 27169. This is a very low power picture of the sarcoma. At the right the picture shows oval or round white spaces surrounded by dark zones. The white spaces are blood vessels and the dark zones consist of sarcoma cells. In other words this part of the growth presents the typical appearance of perithelial angiosarcoma.

She had had five children. Her only previous illness had been typhoid fever when she was 20 years of age.

On examination the abdomen was found markedly enlarged and tense. It was symmetrical and suggested the picture of a large ovarian cyst. The umbilicus was indurated, but in its center was a small hernia.

Operation, June 14, 1921. On opening the abdomen Dr. Warnshuis found the bowel, mesentery, and omentum adherent to papillary masses. There were secondary growths in the liver, and enlarged mesenteric glands. The abdomen contained little fluid. As nothing could be done, the umbilicus was excised and the abdomen closed.

The patient died in 36 hours, apparently of shock coupled with pulmonary engorgement.

In answer to a further query, Dr. Warnshuis, under date of October 28, 1921, says: "I am sorry that it was not possible to secure a postmortem, because then we would have been able to determine from just what structures the sarcoma arose. From the physical examination and from the apparent density of the mass in the pelvis I would advance the conjecture that it arose from the ovary."

Gyn. Path. No. 27169. The specimen which consists of the umbilicus with a little of the surrounding skin is 3 centimeters long, 2 centimeters broad. It consists in large measure of a tumor springing from the umbilical depression. The tumor measures 2.3 by 2 centimeters and the overlying skin is stretched and smooth. The tumor on section appears uniform, is rather soft, is somewhat porous and differs entirely in texture from those secondary growths usually found at the umbilicus. The latter are invariably hard and fibrous-looking.

With the low power one sees a very cellular growth embedded in a small amount of loose stroma. At many points it is perfectly evident that the growth is arranged around vessels, and we see longitudinal or cross sections of them (Fig. 17). The blood vessels are small, have very thin walls and are surrounded by spindle cells. These are cut either longitudinally or transversely: sometimes the spindle cells appear to run parallel with the long axis of the vessel, sometimes transversely. The more solid portions of the growth present the usual picture of a spindle-cell sarcoma. There has been some hæmorrhage into the growth in the past, as evidenced by the fact that quite a number of the cells have taken up yellowish brown granular pigment. There is also considerable œdema and liquefaction. The growth is a perithelial angiosarcoma.

This is the first sarcoma of the umbilicus that we have encountered. From what Dr. Warnshuis said, it was impossible to determine with certainty the source of the original tumor, but he came to the conclusion that it was in all probability from the ovary.

AN AMNIOTIC UMBILICUS

This condition is characterized by an absence of the skin around the umbilicus, the defect being replaced by amnion which is reflected upon the abdomen from the cord. In such cases the surrounding abdominal wall is usually intact.

On July 2, 1919, Dr. Margaret Tyler, of the Department of Obstetrics and Gynecology of the New Haven Hospital, wrote me concerning a case that had come under her care. The letter is as follows:

"I am sending you the picture of a baby born on our ward 2 months ago. This shows several interest-

ing conditions, among which are chondrodystrophy, internal hydrocephalus, congenital cystic œdema and a condition at the umbilicus about which I want to ask your opinion. The skin has not come together in the usual manner and does not extend up the cord, the intestines are plainly visible through the cord with apparently nothing but peritoneum and amnion over them. It conforms very well, it seems to me, to the condition described in your book on the umbilicus as an amniotic umbilicus. There is no real hernia, as the intestines do not protrude through the defect in the abdominal wall. Will you be kind enough to tell me if this is a true amniotic umbilicus?"

Dr. Tyler's surmise was correct.

UMBILICAL HERNIA AT BIRTH

It is probable that umbilical herniæ at birth are due to one of three causes or to a combination of these.

1. Stretching of an amniotic umbilicus; (2) the escape of abdominal contents through a patent umbilicus; (3) the failure of the intestines to recede into the abdomen.

As we all know, in the early months of fœtal life, the intestines extend into the cord.

Dr. George L. Streeter was good enough to send me the picture from which Figure 18 has been made. Here we can readily see intestinal loops shining through the wall of the umbilical cord.

Prompt operative interference is the only treatment to be thought of. Delay of a few hours may be fatal.

On January 8, 1920, I received a letter from Dr. William I. Stanton, of Washington, telling me of a most instructive case that had come under his care. His report is as follows:

"I am taking the liberty of writing you in regard to a case of hernia into the umbilical cord. It is the first one I have seen.

"I delivered a girl baby at term in a private home on December 22, at 2.15 in the morning. There was a large mass in the abdominal end of the cord, about the size of my fist. On holding up the cord and placing the lamp distal to the mass I could see the intestines through the amniotic covering of the cord. The blood vessels in the cord entered the abdomen to the right of and below the hernia. There was a small cyst of the cord at the junction of the hernial mass. The cord was ligated distal to the mass.

"Immediate operation was advised, but the parents would not consent. The cord and hernial mass were dressed with sterile gauze and the child put to bed.

Fig. 18. Hernia into the umbilical cord.

This photograph was kindly sent me by Dr. George L. Streeter, director of the Carnegie Research Laboratory in Embryology at the Johns Hopkins Medical School. No. 1585. Length of head and trunk 19 centimeters. The cord at the umbilicus is mostly colored melanotic, and shining through its translucent parts are the dark outlines of intestinal loops. As one passes toward the fetal abdomen its normal size and appearance are [illegible] of a hernia into the umbilical cord.

"I visited the patient next morning and, on examining the hernia, noted that the intestines had changed in color to a dusky red. The parents were informed that unless the child was operated on the baby would perish, and that if not allowed to operate I would disclaim the case.

"I finally obtained permission to operate and took the infant to the Georgetown University Hospital. Dr. Thomas F. Lowe was called to give

Fig. 19. Sloughing hernia of the umbilical cord.

C. H. I. No. 18359. Baby P. This was the picture noted on the ninth day when the child came to my office. At the umbilicus was a large, foul mass. After removal of the secretion, the surface of the growth was found covered by a very thin, parchment-like membrane, which was in some places dry and crackly, and at other points represented by a purulent membrane. Coming off from the side of the mass was a mummified cord. The abdominal skin was carried up on the surface of the tumor for a considerable distance forming a definite collar. For the appearance of the contents of the sac see Figure 20.

ether and we operated at two in the afternoon just 12 hours after the time of birth.

"On opening the amnion and peritoneum we found the hernia to consist of the colon, cæcum, appendix, and small intestine, in all about two feet. The intestines were adherent to the wall of the sac over one-half its area. The umbilical ring admitted the tip of the index finger. The adhesions were freed. An incision was made through the umbilical ring and continued for about 2 inches. The bowels were returned to the abdominal cavity and the incision and umbilical ring closed with three silkworm-gut mattress sutures, the sac and skin edges having been cut away from the umbilical ring previous to this. The bowels showed signs of beginning strangulation. The appendix was not removed as I did not wish to prolong the operation unnecessarily. The infant was returned to its mother the same night and a regular four-hour feeding begun. The patient made an uneventful recovery and the sutures were removed on the twelfth day."

The following case exemplifies the tragedy that is almost sure to occur where the hernia of the cord remains for several days. Even in a few hours the outer covering may become dry and crinkly, and the intestines show much cyanosis.

I did not see this child until the ninth day. At this time there was a peritonitis.

Sloughing and Necrotic Hernia of the Umbilical Cord

C. H. I. No. 18359. Baby P., age 9 days, was admitted to the Church Home and Infirmary January 14, 1918. As soon as the baby was born a tumor was noted at the navel. The midwife, Anna Parr, said that the cord came off from the edge of the right side. The umbilical mass was 4 centimeters across, circular, and projected about 3.5 centimeters from the surface of the abdomen (Fig. 19). The skin was carried up on the surface of the tumor for at least 1 centimeter and then ended as a pinkish ridge. When I saw the child, it was impossible to detect any intestinal coils through the membrane covering the tumor. The surface of the tumor was covered with pus and it had a very fetid odor.

Operation. After carefully cleansing the tumor as far as possible, we opened the abdomen at the base of the mass, and continued the incision around the base of the mass until it was completely freed from the abdominal wall. The sac was then slit up and the intestinal contents were exposed (Fig. 20). The amniotic membrane was gradually peeled away from the surface of the intestine, but when we had done this, the intestines were found to be covered with a greenish yellow, fetid discharge. As there was blockage of the bowel, nothing remained for us to do but a resection. We removed about 8 inches of the small bowel, the cæcum, and some of the ascending colon, closed both ends, and did a lateral anastomosis. It was suggested that we might leave one end of the bowel open, and we thought of doing this, but when one remembers the way children cry and the absolute lack of control that one has over them, I thought it was wiser to close the ends of the bowel. We left a small drain in the lower angle of the incision. The child stood the operation well but was very cyanotic before it woke up.

January 15. The child has taken some water with a little sugar and also has taken the breast. As a result of enemata fæcal matter has been discharged by bowel.

After several days there was a leakage and some fæcal matter escaped from the umbilicus. At times nearly all the fæcal matter came away in this manner; at other times there were well-formed stools. Finally all the fæcal matter passed through the bowel and the fistulous tract closed up completely.

January 31, 1918. About 3 days ago the child started vomiting and Dr. Charles L. Summers saw it with me. The infant was apparently doing well until this morning at 6:30 when he suddenly died.

Autopsy showed that the peritonitis which we had found at the time of operation had persisted and that there were purulent accumulations between intestinal loops and down in both the right and left flanks as well as in the pelvis. It is almost unbelievable that a child with such widespread peritonitis could have survived 18 days after such an operation.

Had the child been brought to the hospital within the first 24 hours and before any peritoneal infection had occurred, the operation would, of course, have been a very simple one and the prognosis would have been good.

One of the most brilliant results in such a case was in the one operated on by Dr. Edward N. Reed of Clifton, Arizona. This case was recorded in the *Journal of the American Medical Association* and is reported in full in *Diseases of the Umbilicus*, p. 460.

A SATISFACTORY METHOD OF DEALING WITH INTESTINAL LOOPS DENSELY ADHERENT TO THE WALLS OF AN UMBILICAL HERNIA

In 1918 I saw a patient, 78 years old, who had a partial intestinal obstruction due to a very large umbilical hernia. At operation I found many loops of bowel so adherent to the sac that their liberation was impossible. The patient was not in good condition and we were in a serious dilemma.

Finally, I dissected the skin away from the sac and then with the aid of transmitted light separated the loops from one another, leaving pieces of sac attached to the loops of intestine. When all of the bowel had been unraveled, we had at least thirty to forty ragged pieces of sac attached to the bowel. These "patches" were trimmed off precisely as would be the repair patches on the inner tube of a bicycle tire. The surfaces of the patches were relatively smooth; they did not bleed. The intestines were returned to the abdomen and the hernial opening closed. The patient, a physician, is still in active practice, although 82 years old.

This method will undoubtedly be of value in a certain group of umbilical herniae.

The case has been reported in detail in the *Journal of the American Medical Association*.

PERSISTENCE OF THE URACHUS[1]

Very little relating to the urachus has come to my attention during the last 6 years.

[1] Disease of the Umbilicus, p.

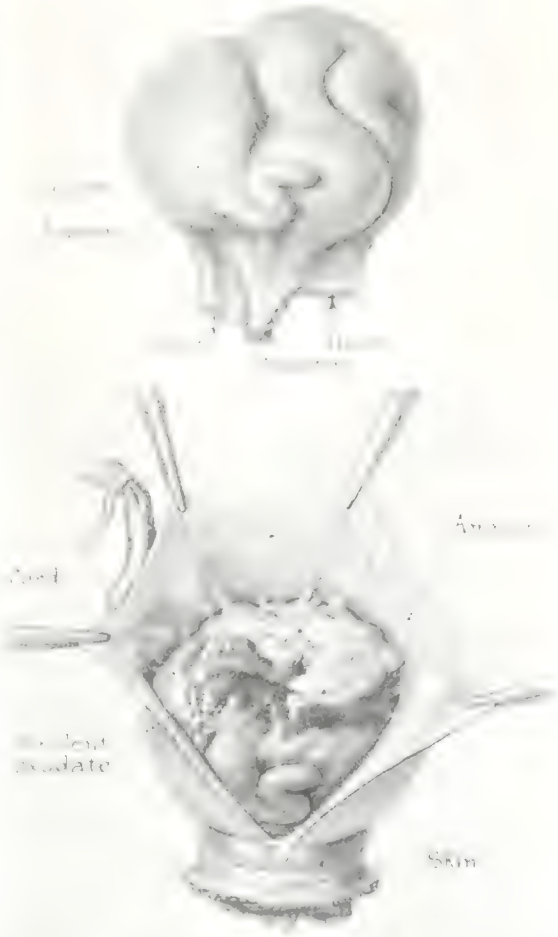

Fig. [illegible] Hernia of the umbilical cord accompanied by general peritonitis and partial intestinal obstruction. Removal of the contents and 3 inches of the small bowel that were incarcerated and obstructed in the sac. Death on the ninth day after operation, from a complication of the general peritonitis.

CASE No. [illegible]. Baby P. His bowel passed through the hernial sac and its contents protruded. At operation from the abdomen was opened at the base of the sac and the incision continued all the way around the base. When the sac had been completely severed from the abdomen it was possible to [illegible] from the abdominal wall [illegible] the contents [illegible] and [illegible] procedure [illegible] opened [illegible] the latter procedure [illegible] the [illegible] [illegible] the appendix [illegible]

Fig. 21. Persistence of the lower end of the urachus.
C. H. I. No. 17084. Mrs. M. K. June 11, 1917. The umbilicus is usually prominent. In the mid-line below is the urachus which has been ligated. At the point of ligation it was 4 millimeters in diameter; as it passed away from the bladder, it became gradually smaller, and half way to the umbilicus disappeared. At the bladder the urachal stump was treated just as when dealing with an appendix.

I have seen one case with persistence of the vesical end of the urachus, and recently Dr. John E. Cannaday of Charleston, West Virginia, gave me the report of a case in which there was marked dilatation of the urachus associated with an imperforate urethra and absence of the rectum.

On January 25, 1922, when opening an abdomen in a case of pelvic inflammation, I encountered a urachal cyst measuring about 8 by 7 millimeters. This contained clear fluid and had very thin walls. It was directly continuous above and below with the urachal cord which did not average over 1 millimeter in diameter.

Persistence of the Vesical End of the Urachus

C. H. I. No. 17084. Mrs. M. K., age 31, entered the Church Home and Infirmary June 11, 1917. She was referred to me by Dr. H. P. Fahrney, of Frederick, and gave a history of having had a slight umbilical discharge at times. She also gave a definite history of chronic appendicitis and complained of a vaginal discharge.

Operation. We opened the abdomen in the mid-line, making an elliptical incision which included the umbilicus. This incision was continued downward, much care, however, being exercised to avoid the urachus. The urachus was examined and found to vary from 1 to 4 millimeters in diameter (Fig. 21). The dilatation was a gradual one increasing as one approached the bladder. We clamped the urachus near the bladder, tied it with catgut, and then took a purse-string of linen thread, turning in the stump just as one would do in dealing with an appendix. The area was then reinforced with catgut. The appendix was everywhere covered with adhesions. It was removed.

The patient made an uneventful recovery.

Absence of the Rectum, Imperforate Anus, Imperforate Urethra, Marked Dilatation of the Urachus

At the meeting of the Southern Surgical Association at Pinehurst, North Carolina, December 14, 1921, Dr. John E. Cannaday of Charleston, West Virginia, gave me a written report of the following case.

"On July 20, 1921, an infant, 36 hours old, was referred to me by Dr. Atlee Mairs of Charleston, W. Va.

"Examination shows a poorly developed infant, male, abdomen large and protuberant, distended in bladder region, flat to percussion over bladder area, anus absent, no dimpling, abdominal distention more noticeable on left side.

"The child has not voided urine. Am unable to introduce catheter into bladder, firm obstruction met with in perineal region. Diagnosis: imperforate anus, imperforate urethra.

"Operation. Novocaine anæsthesia. Right rectus incision in left lower abdomen. Exploration shows entire absence of rectum, a fibrous cord being in the location of the sigmoid. Ascending colon greatly distended.

"Urinary bladder greatly distended. Urachus distended all the way from the umbilicus to the bladder; diameter of urachus about 3 centimeters.

"The lower portion of the sigmoid was brought up into the wound, incised, and a rubber catheter fixed in the lumen by catgut sutures. The sigmoid was attached to the parietal peritoneum at that point.

"It was thought best to attempt to relieve the urinary obstruction by way of the umbilicus. A small probe was gently insinuated into the folds of that structure and a flow of urine immediately appeared at that point. A small rubber catheter was

inserted at the umbilicus and about 1 ounce of normal urine were recovered. The orifice was gently dilated and the tense fullness of the urachus and bladder had by this time disappeared.

The patient was removed from the hospital the next day by its parents. The living conditions at their home were unfavorable and the baby succumbed at the end of 10 days from inanition. No autopsy was obtained."

COMMENT

In the foregoing pages I have given a short account of the umbilical and urachal conditions that have come under my observation during the last 6 years. Our knowledge concerning lesions of this region is steadily increasing. If pathologists, physicians and surgeons will systematically record abnormalities of the umbilicus coming under their care, only a few more years need elapse before our knowledge of diseases of the navel will be fairly complete.

I cannot let the opportunity pass without thanking those who have written me and also sent me specimens, slides and pictures of their cases. I am under many obligations to Dr. John Howland. Any interesting umbilical case coming to his clinic at the Harriet Lane Hospital has been brought to my attention, not only for observation but also for treatment.

Dr. Max Zinninger has been good enough to locate quite a number of the cases for me. My heartiest thanks are due to my friend Max Broedel, director of the department of art in medicine, for his excellent drawings, and I am indebted to Mr. Hermann Schapiro for the photomicrographs, which are unusually good considering the thick sections I furnished him. Dr. Benjamin O. McCleary and Mr. Joseph Hoffman have helped me continually in the preparation of the article.

COMBINED TRANSPLEURAL AND TRANSPERITONEAL RESECTION OF THE THORACIC ŒSOPHAGUS AND THE CARDIA FOR CARCINOMA

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MAY 15, 1922, I resected the thoracic œsophagus and the cardia for carcinoma involving both structures. The operation followed a preliminary resection of the fifth to the eleventh ribs and was performed under local anæsthesia, and gas and oxygen analgesia. The left pleural cavity and the peritoneal cavity were opened widely, the diaphragm was split down to the hiatus, the œsophageal stump was sutured to the skin edges in the middle axillary line, and the gastric stump was brought to the surface near the line. The patient recovered from the operation and is able to take food by mouth through a tube connecting the stomata.

REPORT OF CASE

CASE A387727. Mr. J. P. P., age 52, came to the Clinic, March 13, 1922, because of hiccough and difficulty in swallowing for 2½ months. At first his difficulty was in swallowing solid foods, but at the time of admission to the Clinic he was obliged to eat very slowly in order to swallow semi-solids or liquids. He had lost about 15 pounds in weight.

The patient had good color, seemed fairly well nourished, and weighed 129 pounds. The systolic blood pressure was 140, the diastolic 80. The hæmoglobin was 75 per cent and the leucocyte count normal. The Wassermann reaction on the blood, examination of the urine, and roentgenogram of the chest were negative. A bismuth roentgenogram of the œsophagus showed an obstruction at its lower portion. An œsophageal bougie met obstruction about 43 centimeters from the incisors. The obstruction was dilated to 35 F. and a bougie of 45 F. was passed part of the way through. A diagnosis was made of carcinoma of the œsophagus. The patient, after being advised of the seriousness of the situation, favored operation which would offer him a chance for cure.

Preliminary thoracoplasties were performed April 7, April 11, and April 24, under local anæsthesia, and nitrous oxid and oxygen analgesia, at which the fifth to the eleventh ribs inclusive were resected from the angle to the costal cartilage. Resection of the tumor was performed May 15, under local and nitrous oxid and oxygen anæsthesia. An incision was made, beginning to the left of the middle line, a little below the level of the costal margin, and extending outward and upward to the anterior axillary line. The peritoneal cavity was opened and explored. The growth was found to be localized in the cardia, but extended through the hiatus. The thin left margin of the liver adjacent to the cardia was adherent to it. There were no markedly enlarged glands. The incision was then extended upward to about the level of the fourth rib in the middle axillary line, and the pleural cavity was opened. Following the evacuation of several hundred cubic centimeters of serosanguineous fluid the lung was found partially collapsed. There was no embarrassment of respiration following the wide opening of the pleural cavity. A radical operation having been decided on, the diaphragm was split down to the hiatus and the pleura incised over the lower œsophagus. Palpation now revealed involvement of the lower thoracic œsophagus. The right vagus trunk was separated at the hiatus and the left trunk was cut. There was no appreciable change in the patient's pulse or respiration during this procedure. The lower portion of the œsophagus and the cardia were mobilized and about 4 centimeters of the thoracic œsophagus, most of the stomach at the lesser curvature, and the upper third of the greater curvature were resected between clamps with the actual cautery. A segment of the adherent liver edge was also excised. The stomach was closed with two rows of chromic catgut and one row of silk. The upper end of the resulting tube-like residue of the stomach was brought through the median angle of the wound and sutured in place, projecting slightly above the level of the skin. The diaphragm was sutured with continuous chromic catgut. The œsophageal stump was sutured to the depressed skin edges with two rows of silk, the first being placed through the subcutaneous tissue; the second included the skin edge and the outer coats of the œsophagus. The crushing clamp on the œsophagus was left in place. A rubber tube was placed in a small residual cavity below the stoma. The wound was closed with chromic catgut and silkworm gut.

Immediately at the completion of the operation, which lasted about 2 hours, the patient was fully conscious and rational; his pulse was 130, and of fair quality. The blood pressure just preceding operation was 120 systolic, and 96 diastolic; the pulse was about 90. During the first hour of operation the blood pressure remained elevated to between 130 and 144 systolic, and 90 and 118 diastolic. For a brief period during the dissection of the growth at the hiatus, the blood pressure fell to 122 systolic and 100 diastolic. It fluctuated between 130 and

Fig. 1.—(A85727) Roentgenogram of the œsophagus filled with bismuth, showing the stricture at the cardia.

Fig. 2.—A

144 systolic during the last hour of operation, falling to 110 systolic and 102 diastolic just as operation was completed. The patient was transfused with 500 cubic centimeters of blood, not so much because of loss of blood, as because of the severity of the operation. His blood pressure one-half hour after operation was 126 systolic and 100 diastolic. The morning after operation his pulse was 135 and the quality was fair. His temperature was 100.8°. Fluid was administered by proctoclysis, about 2 liters being absorbed by rectum the first 24 hours. The pulse remained about 120 for 48 hours and then dropped to between 90 and 120 where it remained for the next week. The temperature rose to 101.2° the day following operation, and then gradually subsided to normal on the sixth day with slight fluctuations between 98 and 99 until the tenth day.

Doctor A. C. Broders reported on the specimen as follows: "The excised specimen consists of a cardiac portion of the stomach and about 4 centimeters of the lower end of the œsophagus. An annular carcinoma of the stomach has infiltrated beneath the mucosa, producing a mass measuring in the fixed specimen 6 by 7 by 3 centimeters. In areas the growth extends through the serosa. There is practically no ulceration. The whole picture is not unlike the leather bottle type of carcinoma, in that it shows little tendency to produce ulceration of the mucosa. The growth involves the lower portion of the œsophagus. A number of lymph nodes show metastasis. There is a margin of normal tissue several centimeters wide above and below the growth."

Three days after operation the crushing clamp was removed from the [illegible] about 10 cubic centimeters of thick yellowish, sour-smelling material was evacuated. The stump [illegible] for the sloughing margin, was pink and appeared viable. By the tenth day the slough had separated and the œsophagus was firmly adherent to the edges of the skin. Except for a little [illegible] wound in the skin healed promptly. A small pocket below the œsophagus was kept clean by irrigation.

On the fifth day, the tubular end of the stomach protruding through the wound was opened. A catheter was inserted [illegible] and milk, cream, and lactose were given through it. Later, eggs, beef juice, thick soups, and fruit juices were added to the diet. The caloric intake was increased after a few days to [illegible] calories daily. On the [illegible] meter tube was passed [illegible] when the patient swallowed a glass of milk, there was very little leakage. [illegible] tieth day, he swallowed liquids containing [illegible] calories of food. He swallowed without apparent effort but slowly.

During the [illegible] diarrhœa but this subsided. On the [illegible] day, the stool was formed and has remained so to the present time. The patient [illegible] very well [illegible] found to be well [illegible]

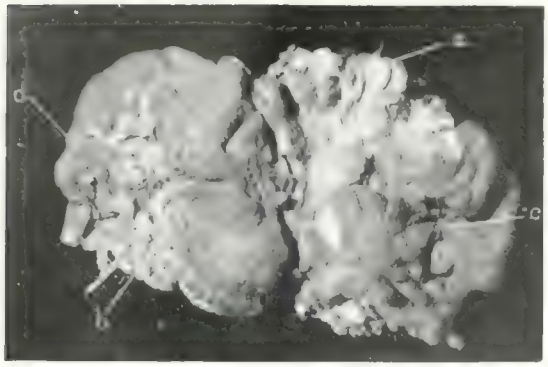

Fig. 3. (A387727.) Photograph of the excised specimen, the stomach and œsophagus having been split in a longitudinal direction. *a*, Lower thoracic œsophagus; *b* and *c*, the borders of the tumor; *d*, the normal gastric mucosa.

the twelfth day. He then improved markedly and began to walk by the end of the third week. Six weeks after operation, he was gaining steadily in weight and strength and his general health was in all respects quite satisfactory.

July 21, the patient has gained several pounds in weight. His hæmoglobin has increased from 35 to 65 per cent and he is now taking all his nourishment including soft solids such as boiled egg, cereal, milk toast, and so forth, by mouth.

DISCUSSION

This is the second reported case in which operation was performed by this method. The first case was one reported by Zaaijer, in 1913. His procedure differed only in that he performed a preliminary Kader gastrostomy and a single stage rib resection, but the patient developed alarming respiratory embarrassment following this extensive single stage rib resection. He was able to take liquid food by mouth and was in a satisfactory condition at the time of the report, about 1 month after the resection.

The first attempt to resect the thoracic œsophagus and the cardia for carcinoma, involving both structures and necessitating a transpleural exposure, was made by Mikulicz, in 1896. To avoid pneumothorax he obliterated the lower anterior portion of the pleural cavity by approximating the diaphragmatic pleura to the parietal by means of sutures through the diaphragm and chest wall. The patient died of peritonitis. After Sauerbruch had perfected his differential pressure chamber, he operated on a relatively

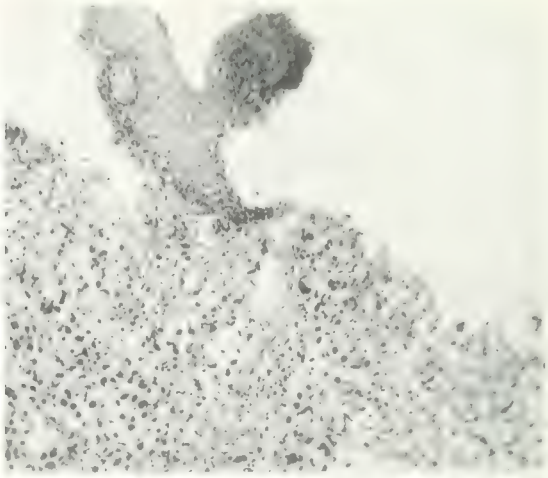

Fig. 4. (A387727.) Photomicrograph showing the rapidly growing, highly malignant carcinoma in close relationship to the squamous epithelium of the œsophagus.

large number of patients by the transpleura route, anastomosing the stump of the stomach lifted into the pleural cavity to the resected thoracic œsophagus, but fatal leakage at the site of anastomosis invariably followed. Only one case promised a successful outcome, but the patient died from pneumonia on the fourteenth day. Many cases have been reported by others, but all resulted unfavorably. Despairing of success by such methods, Ach and others dislodged the resected œsophagus by a stripping or dissection operation, displacing it to an antethoracic position through an incision in the neck. None of the patients operated on in this manner, in which the cardia was also resected, recovered from the operation.

In the consideration of operative methods and case reports a clear distinction must be made betwen cases of carcinoma involving the hiatus and thoracic œsophagus, and cases in which these structures are normal. In the case herein reported it would have been impossible to effect an anastomosis between the œsophagus and gastric stumps below the diaphragm, even had it been possible to separate the growth infiltrating the hiatus. After the tumor, with 1 centimeter of normal œsophagus, had been resected, it was with great difficulty, working within the pleural cavity, that I loosened the œsophagus suffi-

ciently to reach the depressed skin margin and it lacked several centimeters of reaching the level of the hiatus of the diaphragm.

The first successful complete gastrectomy was performed by Schlaetter in 1897. There is some uncertainty as to whether many of the cases reported later were complete gastrectomies. Forty-six cases are reviewed in the literature. In 1917, W. J. Mayo performed a total gastrectomy including about 16 millimeters of the œsophagus. The patient is in fair health 5 years after operation.

Resection of the cardia for carcinoma, mobilizing the normal œsophagus at the hiatus, and pulling down the thoracic portion sufficiently to effect an anastomosis to the stump of the stomach or loop of the jejunum below the diaphragm without leakage has proved very difficult. The operation was first successfully performed, in 1908, by Voelcker, who pulled the œsophagus down and anastomosed it to the resected stomach. The site of anastomosis leaked for 4 weeks and then healed completely. The second case with a favorable outcome was reported by Kuemmel in 1910. Failing in an attempt to anastomose the stumps he fastened rubber tubes into the openings in the duodenum and stomach bringing the other ends of the tubes through the abdominal incision and packing around them. Healing brought about a partial anastomosis which he proposed to complete later by operative measures. Bircher, in 1918, in a third case in which the patient survived, effected an anastomosis which did not leak. There was marked ptosis of the stomach, however, and presumably the abdominal portion of the œsophagus was also elongated.

Complete gastrectomy seems to have been more successful than resection of the cardia, probably for the reason that in most of these cases practically all of the abdominal œsophagus has been left for the anastomosis.

Fig. [illegible] Photograph of the patient [illegible] month after operation.

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INFECTION IN THE MEDIASTINUM IN FULMINATING CASES OF EMPYEMA[1]

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COMPARATIVELY recent experimental studies on monkeys have shown that the infections of the lung causing pneumonia reach the alveoli, at least in many cases, by way of the interstitial tissue (1). The organisms gain access to the subepithelial areolar tissue of a bronchus and are conveyed thence to the parenchyma of the lung, causing vascular damage leading to the exudate which, together with the organisms, breaks into the alveoli. It is through this interstitial framework of the lung that the infecting organisms are carried to the subpleural structures, causing pleuritis and eventually empyema. The studies of MacCallum (2), Opie and others (3) have demonstrated this course of events in many cases of empyema occurring in the Army, particularly when the offending organism has been a streptococcus. An acute interstitial bronchopneumonia sometimes led so rapidly to an empyema that a massive pleural exudate masked the physical signs of any pneumonic consolidation which might be present and appeared to be the primary condition. Fulminating cases of empyema of this nature were frequently associated with pericarditis or peritonitis, or all three localizations occurred so nearly simultaneously that the impression was created that the streptococcus had a particular affinity for serous membranes and that this affinity explained the occurrence of the "polyserositis."

The statistical data furnished by approximately 4,000 cases collected in the form of special empyema records of non-traumatic empyema in the Army within the United States, led to the belief that these cases of polyserositis were in reality not the result of any special predilection of the streptococcus for serous membranes, but might be a very simple and inevitable consequence of the anatomical relations of the parts concerned and the abundant exudation of serum which follows infection of any soft tissues with streptococci. In other words: Given, the character of damage occasioned by the streptococcus with a primary localization in the interstitial tissue of the lung, an extension of the infection to the pericardium and peritoneum might well appear an inevitable consequence.

One of the striking phenomena of a fulminating infection of soft parts with the streptococcus is the failure of the inflammatory reaction induced in the tissues to confine the infection. It spreads rapidly along lymphatic channels but is not confined to these; for a phlegmon, due to the presence of the organisms in the areolar tissue, is not uncommon. If this process is inaugurated in the interstitial tissue of the lung, an extension to the pleura is a natural consequence. But is there any valid reason why a similar extension toward the hilum should not also take place? Such an extension would infect the mediastinal structures and bring the organisms into a relation to the parietal pericardium similar to that which in the case of the visceral pleura gives rise to empyema. Furthermore, if the organisms are present in the spaces of the mediastinal areolar tissue they may be conveyed to the subperitoneal structures; for the external coat of the œsophagus and the adventitia of the aorta and other blood-vessels passing through the diaphragm are but a part of this areolar tissue. There is a further consequence of this assumed extension: An infection of parts so freely open to lymphatic drainage would almost inevitably lead to entrance of the organisms into the blood stream.

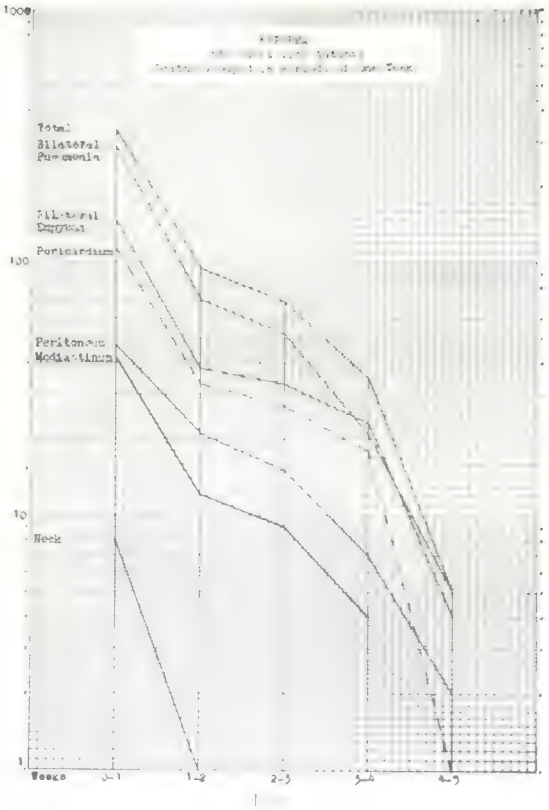
The sequence of events here pictured would doubtless long since have become familiar to clinicians had the process been

[1] Read before the Surgical Section, New York Academy of Medicine, February 8, 1922.

TABLE I. EMPYEMA: 538 CASES WITH AUTOPSY; DEATHS GROUPED IN PERIODS OF ONE WEEK

a leisurely one, or one less rapidly fatal. There is no definite record showing the recognition of acute mediastinal infection during life among the histories of 3,889 cases of empyema, yet this condition was noted at autopsy in 67 of the 531 necropsies on cases that died within 4 weeks after empyema was recognized. This amounts to 12.6 per cent. There was, however, one case which may have been a mediastinal abscess, which was recognized during life and successfully treated by trephining the sternum. This may, however, have been a pleural pocket extending across the median line, there being no way of reviewing this case to determine whether the pus was within or outside the pleura. Of these 67 autopsied cases with mediastinitis, 42 died within 1 week after the date on which the existence of an empyema was first recorded.

Forty-six of the cases were definitely associated with streptococcus in the pleural exudate, 11 with pneumococci, of which the type was determined in 10, with the following results: Type I, 1; Type III, 1; Type IV, 8. Fifty-seven, or a trifle over 85 per cent, had bilateral pneumonia; 44 (nearly 66 per cent) had bilateral empyema; 35 (52 per cent) pericarditis, and 8 (nearly 12 per cent) peritonitis. Of all the fatal cases of peritonitis, nearly 8 per cent presented a mediastinal infection sufficiently striking to be noted at autopsy and this is also true in 11.5 per cent of the cases in which a pericarditis was mentioned in the protocol. The fulminating character of the cases is shown by the fact that in 20 (nearly 30 per cent) no operation was attempted.



There is no evidence that the pathologists assigned to Army hospitals laid particular stress upon these mediastinal infections or their association with pericarditis. It is obvious that a mediastinal infection might be secondary to a pericarditis, and this was the explanation of its occurrence which appears to have been generally accepted when attention was directed to an association between the two conditions. But there was a case at Camp Logan in which the postmortem findings were interpreted as indicating that the pericarditis was secondary to a mediastinal infection, as is shown by the following note made by Major J. M. Willis: "In this case a diagnosis of empyema of the anterior mediastinum was made and obstruction from compression of the trachea demonstrated more than a week before death. The suddenness of the development of the right empyema and the purulent pericarditis, with the finding of [illegible] from the mediastinal abscess to the pericardium, led

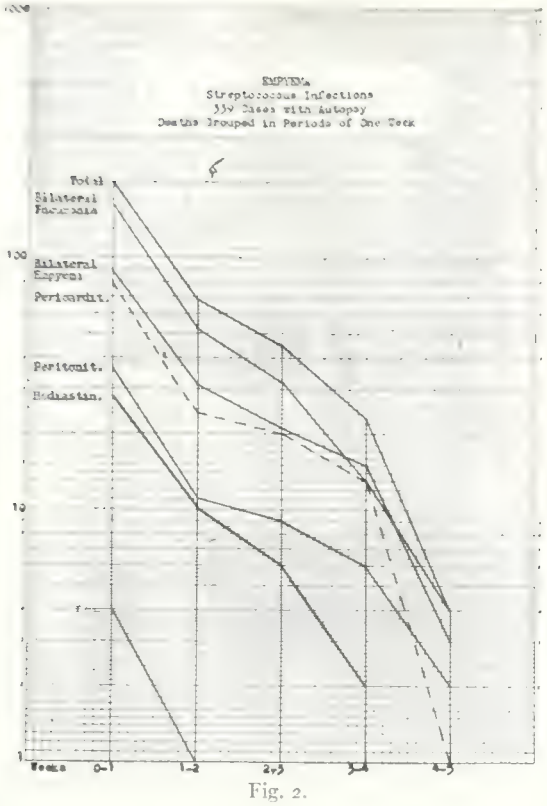


Fig. 2.

us to believe that the mediastinal trouble was the source of origin of the other suppurations." The clinical history of this case has not been traced, but an extract from the autopsy protocol states that the pericardium was greatly distended and contained about a quart of pus and fibrinopurulent exudate without adhesions. Beneath the heart there was a tract that led back to the region of the bifurcation of the trachea, but did not communicate with the pleural cavities. The heart was slightly enlarged and flaccid, the valves normal. At the bifurcation of the trachea there was a mass of glands about the size of two fists from which when cut there exuded a cheesy material.[1]

Bacteriological examinations of the mediastinal fluids were rarely made at autopsy. There is a report from Camp Bowie of eight such examinations made upon cases in which both mediastinal and subcutaneous emphysema were present. In three of these no

TABLE II — EMPYEMA, STREPTOCOCCUS INFECTIONS; 339 CASES WITH AUTOPSY; DEATHS GROUPED IN PERIODS OF ONE WEEK

		Bilateral pneumonia		Bilateral empyema		Pericarditis		Peritonitis		Mediastinitis		Cervical infection	
						79	38.7						
		68											
				21	46.7								
				15	65.2								
						136	40.6						
	262	77.3	158	46.3									

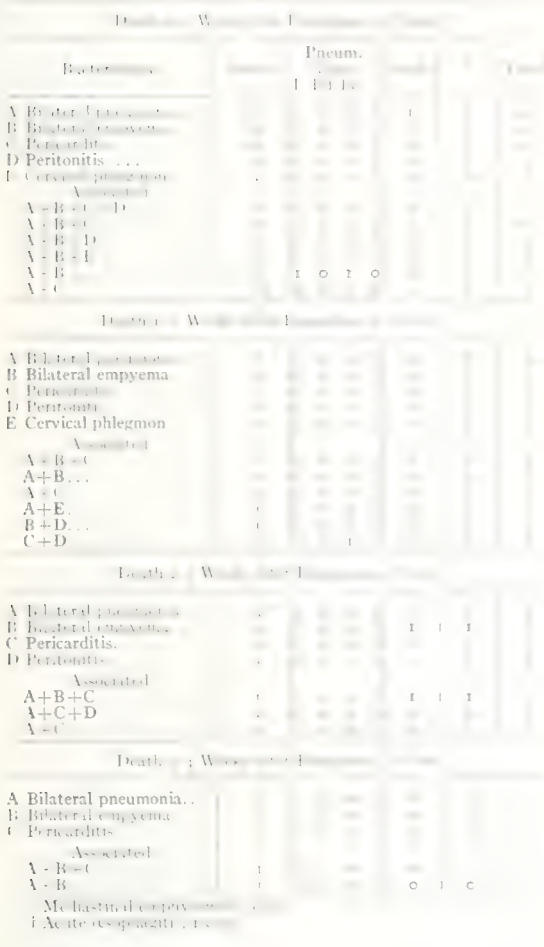
growth was obtained; in three the cultures yielded pneumococcus, Group IV, and the remaining two cases streptococci, one hæmolytic and the other not (4). It is worthy of remark that in all the instances in which there were positive findings the organism was either a streptococcus or pneumococcus, Group IV. In all these cases the corresponding organism was found in the blood postmortem.

It would be difficult, from autopsy findings alone, to determine definitely the actual sequence of events leading to the conditions found. But the statistical and experimental evidence at least suggest that a mediastinal infection may be an intermediate step between infection of the areolar tissue within the lung and a pericarditis originating in the parietal layer of the pericardium.

The statistical evidence is taken from special empyema records collected for the *Medical History of the Great War*. The data are summarized in the accompanying tables (Tables I and II and charts Figs. 1 and 2).

The tables give the total number of cases, and of these the number in which bilateral pneumonia, bilateral empyema, pericarditis, mediastinal infections and abscesses or phlegmon of the neck were observed and noted in the protocols. These figures are arranged in groups according to the week in which death occurred after the recognition of a pleural infection. The percentages which these figures bear to the total for the corresponding period are also given, so that it is possible to see at a glance the degree of constancy in the

TABLE III.—EMPYEMA, 67 CASES WITH MEDIASTINITIS



ratios of the various conditions during the different periods of time.

The charts (Figs. 1 and 2) present these data in graphic form, plotted upon a logarithmic scale. The particular advantage of this scale is that parallel lines indicate identity in the ratios between the quantities represented by those lines.

Both the tables and charts make it evident that there is a remarkably close relationship between the six conditions which they include during the first 2 weeks. In Table I, the percentage of peritonitis is relatively low in the first week, but in Table II, which is confined to the cases with streptococcus empyema, the percentage of peritonitis

† Type IV.

is greater in the first week than in the second. It is not unlikely that the peritonitis occurring in cases of pneumococcal empyema owed its origin to a secondary infection with streptococci and that this occasioned some delay in the peritoneal infection.

In this connection it is of interest to examine the data concerning the infecting organisms in those cases in which a mediastinal infection was so striking that it attracted attention and was noted in the autopsy protocol. The available data are in most cases derived from reports on the bacteriological examination of the pleural exudates and may not always indicate the organism that induced the mediastinitis.

From Table III it is evident that the great majority of the cases of obtrusive mediastinal infection were associated with streptococci in the pleural fluid. Next in frequency is pneumococcus, Type IV, a somewhat indefinite group containing members which, in the pathology of empyema, produces effects indistinguishable from those occasioned by hæmolytic streptococci. Two cases are reported as associated with a staphylococcus in

Frontal section through thoracic organs. (Acc. 6152, Army Medical Museum.)

the pleura, and one each with pneumococcus Types I and III.

While statistics of this character are highly suggestive they are not wholly convincing, for they do not reveal the mechanism by which the infection is conveyed. The infecting organisms might be carried by the circulating blood or they might follow the spaces in the areolar tissue or be transported through lymphatic vessels.

If it were possible to demonstrate by microscopical examination the presence of bacteria in the mediastinal tissues in a case of empyema complicated with pericarditis in which it was known that the blood was sterile, the localization of these bacteria and the tissue changes in their immediate vicinity might throw light upon the actual occurrence of pericardial infection through this mode of transmission. A search through the material sent from the military Camps to the Army Medical Museum has resulted in securing a specimen suitable for such study.

The case was a private admitted to the Base Hospital at Camp Hancock on January 27, 1919, after having had a sore throat and cough for one day. On admission his tonsils were red and swollen. The diagnosis was: tonsillitis, acute follicular, bilateral; stomatitis, acute; pharyngitis, acute catarrhal. Neither diphtheria bacilli nor streptococci were found in cultures from the throat. The leucocytes in the blood were estimated at 8,800 per cubic millimeter, with 66 per cent of the polymorphonuclear form. The patient did well for 4 days. On February 4, 8 days after admission, a small area of consolidation of the lung on the left side was noted and diagnosticated as bronchopneumonia. The following day his condition was improved and was described as fairly good the day thereafter. But the next day, February 9, vomiting with dyspnœa set in, the pulse became weak and the percussed outline of the heart increased, but there were no friction sounds. He died that morning at 11 o'clock.

An autopsy was held the following day at 1:30 in the afternoon, 26½ hours after death. The following is transcribed from the protocol:

Left pleura. Full of cloudy, yellowish, thin fluid in which are many shreds of whitish coagulum. The lower posterior part of the lower lobe of the lung is adherent to the parietal pleura by recent agglutination so that fluid occupies the upper part of the pleural cavity, the accumulation lying both internal and external to the upper lobe of the lung. The visceral pleura is covered by a layer of fibrinous exudate 1 millimeter thick and the interlobar cleft is closed by rather firm adhesions.

Left lung. Compressed, but solid throughout, practically airless. The cut surface appears uniformly dark red and yields a moderate amount of bloody fluid. There are no evident plugs of fibrin in the alveoli. The bronchi are congested and contain a slight amount of mucus.

Right pleura. Free and contains an excess of clear fluid. There are numerous petechial spots over the posterior and lateral surface of the lower lobe of the lung.

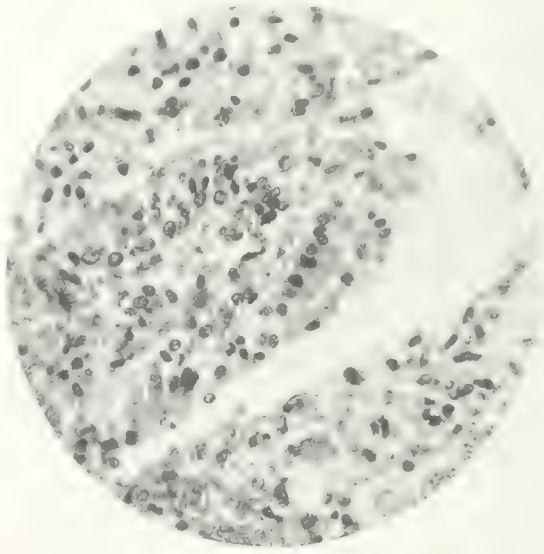


Fig. 4. Section through small bronchus in a case of acute interstitial pneumonia. (Acc. 3048, negative 30927, Army Medical Museum.)

Right lung. There is a wedge-shaped segment of consolidation in the lower lateral portion of the upper lobe. On section this is dark in color, firm in relation to one of the smaller bronchi. The rest of the lung is much congested, especially the lower lobe, which is firmer than usual. The lung as a whole is œdematous, but air-containing.

Mediastinum. The fatty and areolar tissue are œdematous and infiltrated so as to appear firmer and more thickened than normal.

Pericardium. Both parietal and visceral layers are thickened and opaque, evidently from a recent exudate. There are [illegible] cloudy fluid, but no excess.

Heart. Large, muscle pale, cloudy and [illegible] with moderate hypertrophy of the left ventricle. The right side contains a tenacious yellow clot, but the endocardium and valves are smooth.

Anatomical diagnosis. Lobar pneumonia, left upper and lower lobes, acute, resolving. Broncho pneumonia, segmental, acute, right upper [illegible] Pleuritis, purulent left, acute. Pericarditis, fibrino purulent, subacute. Mediastinal cellulitis [illegible]

Cultures. Hæmolytic streptococci from the pericardial fluid and the upper lobe of the right lung. Culture media inoculated with blood from the heart remain sterile.

The thoracic organs were removed at autopsy without separating them from each other, preserved in formaline and sent to the Museum where they are recorded as Accession Number 6152. Figure 3 is reproduced from a photograph of a coronal section through the lungs, heart and mediastinum. In the left lower lobe a patch of acute interstitial broncho-pneumonia is clearly shown, with an infiltration of the interlobular septa extending to the pleura, where one or more tiny subpleural abscesses can be discerned. A heavy fibrinopurulent exudate agglutinates the two pleural surfaces in this region. The

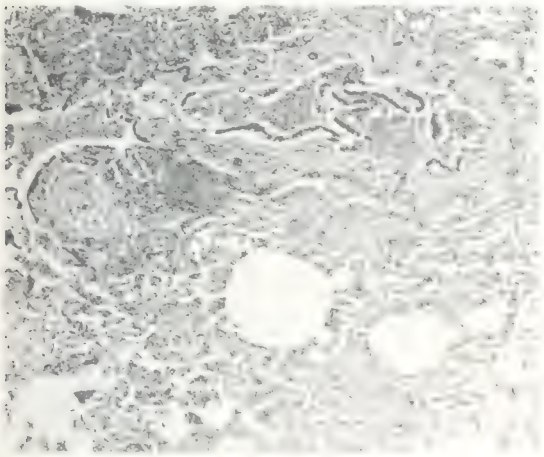


Fig. 5. Section of lung including a small bronchus. There is a partial [illegible] of the peribronchial areolar tissue. [illegible] Army Medical Museum.)

[illegible] Army Medical Museum.)

pericardial sac is lined with a much thinner layer of [illegible] serofibrinous exudate. It was recognized at the autopsy that the mediastinum was also affected, but no [illegible] present in these tissues. The [illegible] peribronchial and mediastinal glands to be enlarged.

From the gross [illegible] microscopical study from portions of the lower lobe of the left lung as well as portions of the parietal pericardium and the thin [illegible] jacent pericardium and the thin [illegible] tissue lying between this and the parietal pleura. Other portions selected for microscopical examination were the tissues at the hilum and within the mediastinal space, some of the latter including the parietal pericardium.

It will assist in the interpretation of the microscopical pictures presented by these sections, if the pathological processes which lead to an interstitial pneumonia and subsequent empyema are [illegible] photographs made at the Army Medical Museum admirably (Figs. 4, 5, 6, and [illegible]

Figure 4 shows a portion [illegible] wall of a small bronchus. The lumen contains [illegible] and cellular detritus. The lining epithelium is [illegible] and the underlying tissues are exposed to the [illegible]

Figure 5 depicts an oblique section of a small [illegible] the [illegible] lumen. In the neighborhood of the [illegible] there is a [illegible] hial interstitial tissue.

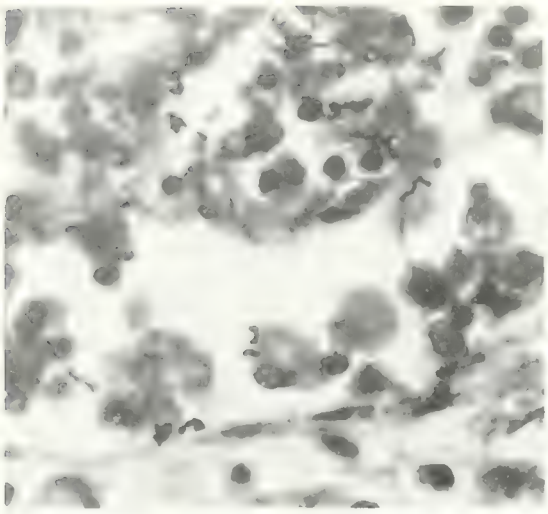


Fig. [illegible] Section of mediastinal lymph gland. (Acc. 33300, negative 33030, Army Medical Museum.)

Figure 6 is taken from a section through the periphery of the lung at a stage in the extension of the interstitial infection when the organisms have reached the subendothelial tissues of the pleura. These are infiltrated with serum containing leucocytes and groups of streptococci. The endothelium has been raised and its disintegration is imminent. The next step in the process would be the infection of the pleural cavity, leading to empyema.

Figure 7 is a section of a mediastinal lymph gland invaded by streptococci.

Returning to the specimen from Camp Hancock, a careful microscopical search through these sections has revealed the presence of isolated diplococci in several situations within the mediastinum. In some places they lie between the fibers of connective tissue, where these are somewhat separated, evidently owing to an inflammatory œdema. In other places the diplococci lie in close relation to the fat cells of the mediastinal adipose tissue.

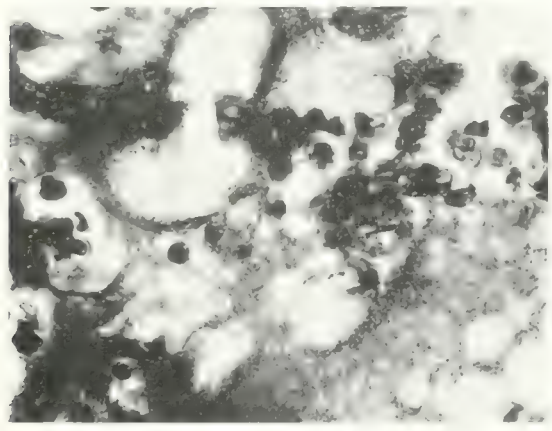


Fig. 9. A short streptococcal chain in close proximity to a fat cell in the peribronchial tissues near center of left lower lobe. Cellular infiltration and the presence of fibrin are evidence of acute inflammation. Slide 615, Acc. [illegible], Army Medical Museum. Photographed at the Rockefeller Institute for Medical Research.

Fig. 8. Outline tracing of Figure 3, showing the regions from which specimens were taken for microscopical examination. Numbers indicate figures.

To give a clear idea of the regions from which the sections were made, an outline tracing of Figure 3 has been made, upon which the localities are indicated (Fig. 8), and photomicrographs of the fields in which the organisms were found are reproduced in Figures 9 to 15. These photographs do not depict quite all of the organisms found in the mediastinal connective tissue. In several instances cocci could be clearly recognized under the microscope when the focal plane was slightly shifted, but attempts to photograph were unsatisfactory.

The diplococci in these sections are morphologically identical with the diplococcus forms in exudates occasioned by the hæmolytic streptococcus. They are not in lymphatic vessels, but lie free in the interstitial lymph which circulates between the tissue elements. The fact that they are isolated and do not occur in groups seems to indicate that they were in transit, being actively transported from place to place by the flow of the fluid in which they were suspended. Had they become fixed in position, presumably their multiplication would have led to the formation of a group of organisms with the production of short chains. Furthermore, there would probably have been a more pronounced inflammatory reaction about the points where they had lodged. That they were present in these tissues during the life of the patient is evidenced by the œdema and fibrinous exudate frequently, but not invariably, found in the microscopical fields which contain the organisms.

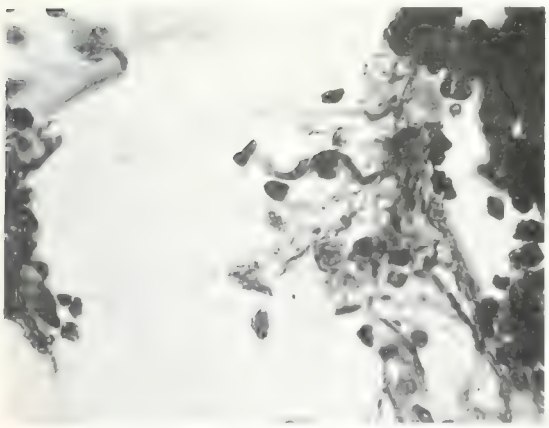


Fig. 10. A single diplococcus in adipose tissue at the hilum of the left lung. Cellular infiltration and fibrin. (Slide 6152–2-a, Army Medical Museum. Photographed at the Rockefeller Institute for Medical Research.)

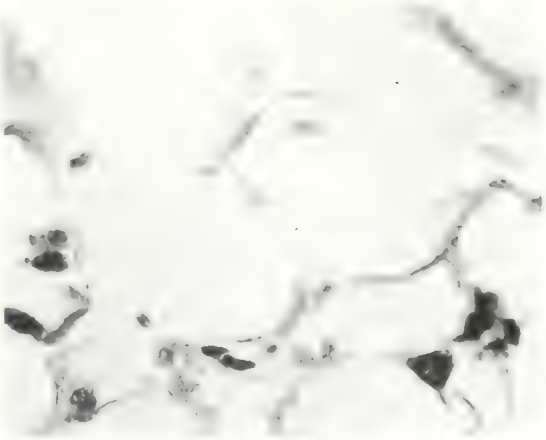


Fig. 11. Diplococci [illegible] (Slide [illegible], Army Medical Museum. Photographed at the Rockefeller Institute for Medical Research.)

In comparison with these observations, it is of interest to make a similar examination of the mediastinal tissues from a case in which a culture from the blood made before death revealed the presence of streptococci.

A section of the mediastinal fat from such a case is depicted in Figure 16. Here one of the two capillaries lying between the fat cells contains several diplococci and the blood is hæmolyzed. The other capillary is occupied by normal blood. There is no evidence of an inflammatory reaction in the tissues. Possibly, a single diplococcus came to rest in this position at the time of death in the one capillary and, the conditions being favorable, multiplied after the circulation of the blood had ceased and an inflammatory response to their presence was no longer possible.

Returning to the case in which the blood was sterile, it is of importance to study the condition of the parietal pericardium.

Figures 17, 18, and 19 are photographs of sections from regions where the pericardium overlies the mediastinal connective tissue. The exact localities from which these sections were made cannot be shown in Figure 8, because they lay in a plane somewhat anterior to the one represented by this photograph, but have been indicated as nearly as possible by the figure 17 on that diagram.

In Figures 17 and 18, a very early stage of pericarditis is shown. A septic œdema has separated the endothelial lining of the pericardium from the subjacent connective tissue of the mediastinum which is also the seat of œdema. Streptococci are numerous in the subendothelial fluid and are also present near the surface of the serofibrinous [illegible] the endothelium normally rested.

Figure 19 depicts a more advanced stage of pericarditis. The endothelial layer has not only been lifted away from its normal support, but is in process of disintegration. Upon the surface is a serofibrinous exudate in which streptococci are abundant. It is worthy of note that although the underlying fibrous tissue is wholly denuded in a portion of this section, it is not invaded with micro-organisms in any degree markedly greater than was the case in the earlier stage of pericarditis shown in Figures [illegible] and 18. This suggests that the flow of the exudate toward the serous surface

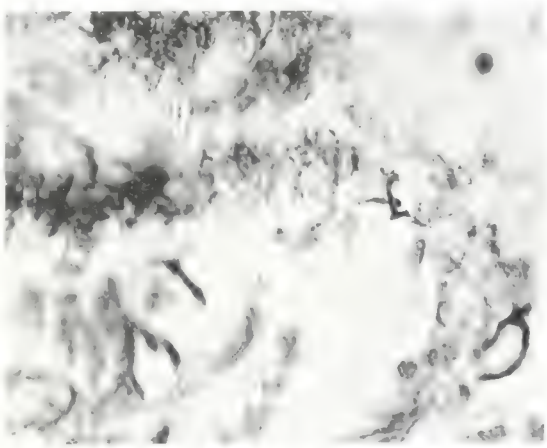


Fig. 12. Diplococci [illegible] (Slide [illegible], Army Medical Museum. Photographed at the Rockefeller Institute for Medical Research.)

Fig. 13. Diplococci in a serofibrinous exudate into the fat and areolar tissue of the mediastinum. (Slide [illegible] b, Army Medical Museum. Photographed at the Rockefeller Institute for Medical Research.)

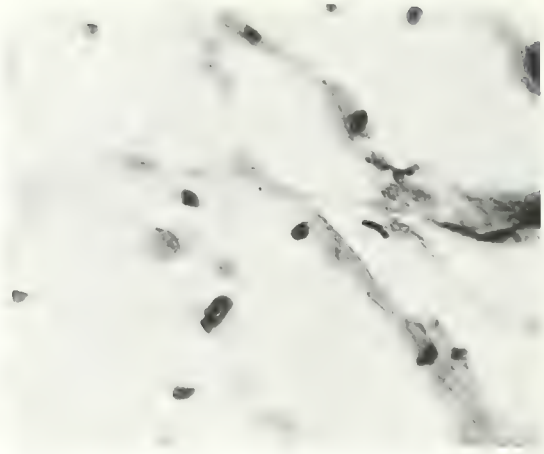


Fig. 15. Diplococci in a serofibrinous exudate into the fat and areolar tissue of the mediastinum. (Slide 615 2-b Army Medical Museum. Photographed at the Rockefeller Institute for Medical Research.)

from these tissues protected them against particulate invasion.

The failure of micro-organisms to pass from a serous cavity into the surrounding tissues after productive inflammation has formed a "pyogenic membrane" of granulations is a matter of common experience and is readily understood so long as this membrane remains undisturbed. But the section through the parietal pleura depicted in Figure 20 suggests that the flow of a serous exudate toward the cavity during the inflammatory stages preceding these productive phases may serve as a protection against the entrance of micro-organisms. It is noteworthy that in cases of empyema the costal wall, external to the parietal pleura, is very rarely the seat of localized suppurations unless the result of trauma.

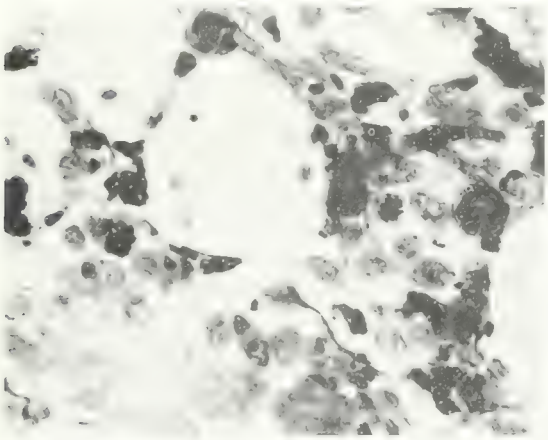


Fig. 14. Diplococci in a serofibrinous exudate into the fat and areolar tissue of the mediastinum. (Slide 615 2-b, Army Medical Museum. Photographed at the Rockefeller Institute for Medical Research.)

Fig. 16. Mediastinal fat in a case in which the blood contained streptococci during life. Two capillaries; one containing cocci and the remains of hæmolyzed corpuscles, the other without cocci or hæmolysis. (Slide 606–1, Army Medical Museum. Photographed at the Rockefeller Institute for Medical Research.)

Fig. 17. Parietal pericardium overlying mediastinal connective tissue. Early stage of pericarditis, comparable with the early stage of pleuritis [illegible] (Specimen 6152-1, Army Medical Museum. Photomicrograph by the Rockefeller Institute for Medical Research.)

In Figure 20, the remains of the parietal pleura can be discerned as a necrotic strand, on one side of which the fibrinopurulent exudate within the pleural cavity contains innumerable streptococci. On the other side of this pleural vestige, no micro-organisms could be recognized with certainty in the serofibrinous exudate that separates the tissue elements forming the deeper layers of the parietal pleura. It is hardly conceivable that the damaged endothelium could in itself constitute a continuous and effective barrier against the passage of even non-motile bacteria. But the coagulations incident to the necrosis of that endothelium together with a flow of fluid, however sluggish, may perhaps suffice to explain the rarity of a transportation of bacteria outward from the cavity.

When the bacteria are primarily in the subendothelial tissues, these conditions are reversed, as is shown by the frequency with which pleural infections follow those of the lung, particularly when the offending organism is of a variety causing the formation of an abundant serous exudate.

The foregoing histological studies offer an explanation of that association of pericarditis with empyema revealed by the statistical data that preceded them. It remains to inquire whether this explanation can be extended to include the occurrence of peritonitis. This inquiry does not demand a search for micro-organisms along the possible paths of transmission; for it has already been shown that they come to lie in the interstices of the mediastinal tissues and it is known that because of some mode of transmission they are also present in the peritoneal exudate. It will suffice to show that the tissues intervening between the mediastinum and subperitoneal tissues are also the site of acute exudative inflammation. Such intermediate structures are represented by the external areolar coats of the aorta and œsophagus.

In the case of the aorta, that an acute exudative inflammation may occur is completely demonstrated by the section through this vessel shown in Figure 21. An abundant serofibrinous exudate occupies the meshes of the areolar tissue of the aortic adventitia which is continuous with that of the mediastinum and the subendothelial tissues of the peritoneum.

That the outer coat of the œsophagus may likewise be affected by an acute exudative inflammation is apparent upon inspection of gross specimens. An example is given in Figure 22. The wall of the œsophagus is greatly thickened and of a light gray color due to the infiltration with inflammatory exudate. In one of the protocols of a necropsy following

tive tissue. Somewhat more advanced stage of
Photographed at the Rockefeller Institute for Medical

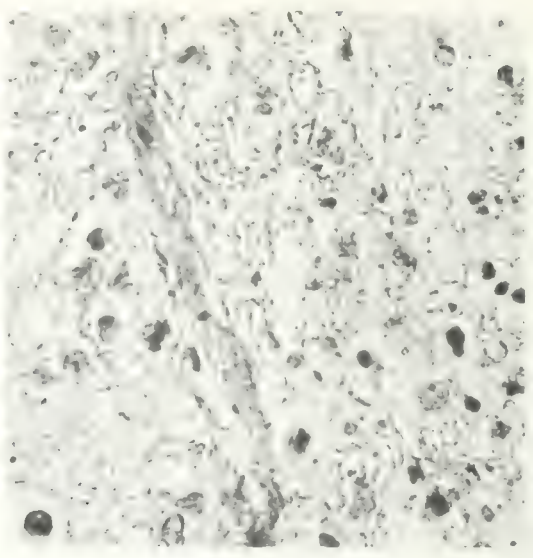


Fig. 20. Section through the parietal pleura, showing the septic seropurulent exudate within the pleural cavity and a serofibrinous exudate in the subendothelial tissues which are continuous with those in the mediastinum. The pleural exudate contains many streptococci. In the subendothelial exudate no micro-organisms could be found. (Acc. 6152, Army Medical Museum. Photographed at the Rockefeller Institute for Medical Research.)

empyema, this inflammation of the œsophagus was so striking that a special note was made of the occurrence of an acute œsophagitis.

In the cases of peritonitis associated with empyema, the inflammation is frequently confined to the upper part of the peritoneum, being described in the autopsy protocols as an acute fibrinous perihepatitis, perisplenitis, or a fibrinous agglutination of the stomach to neighboring viscera. In some instances, the subphrenic and perinephritic abscesses, which occur in the course of empyemata, may owe their origin to this route of infection.

A close analogy to this transmission of infection by way of the mediastinum is offered by the interstitial emphysema that starts in the lungs. The air gains access to the interlobular septa, appears beneath the pleura in beaded lines of bubbles, and passes on toward the hilum. Thence it enters the mediastinum and penetrates the fasciæ of the neck, whence it becomes manifest as a subcutaneous emphysema that may extend to the trunk and limbs.[1] The air is urged onward along this tract of least resistance by the respiratory movements of the thorax which are more vigorous than normal because of dyspnœa and coughing.

Interstitial emphysema was a not very rare complication of influenza and this fact raises the question: What antecedent diseases, other than pneumonia, occurred in the cases of empyema in which mediastinal infection was observed at autopsy? In answer to this question, the available data concerning influenza and measles have been brought together in Table IV and Figure 17.

Taken at their face value, these figures show that exactly one-quarter of the autopsied cases that died with empyema following influenza during the first 2 weeks after the incidence of the empyema had an infection in the mediastinum. The proportion falls to a little less than 1 in 15, when the antecedent disease was measles, but shows the same constancy during the first 2 weeks. The relatively high incidence of mediastinitis in empyema following these two epidemic diseases supports the view that they impair

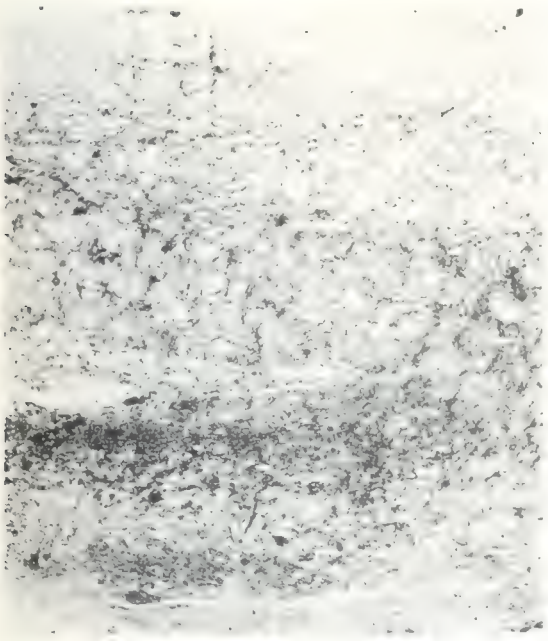
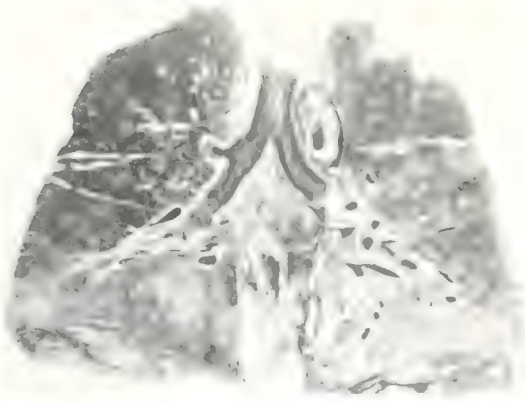


Fig. 21. External portion of a longitudinal section of the aorta from a case of postinfluenzal infection at Camp Devens. There is an abundant serofibrinous exudate in the areolar tissue of the adventitia. (Section kindly loaned by Professor Wolbach of Harvard. Photographed at the Rockefeller Institute for Medical Resear



ugus in a case of interstitial bronchopneumonia with Medical Museum.

the powers of defense against secondary infections.

Emphysema of the neck was noted in two of the cases of empyema included in this series *vide* Table III. In one of these an emphysema of the mediastinum was recorded in the protocol.

It is not obligatory to assume that the direction taken by the infected fluid within the mediastinum and contiguous areolar tissues must be identical with the normal flow of lymph, for this fluid is not confined to lymphatic vessels. It also occupies the interstitial spaces of the areolar tissue which may be likened to a sponge, the meshes of which in these cases of infection are constantly replenished with fluid derived from the damaged vessels and, at frequent intervals, urged by violent dyspnœic respiratory efforts or coughing to expel this fluid along any path which may be open.

Further consequences of infection of these tissue fluids would be the invasion of the areolar tissues of the neck and the eventual entrance of micro-organisms into the circulating blood through lymphatic absorption. This access to the blood stream might be by way of the thoracic duct or might take place within an inflamed lymph gland where the

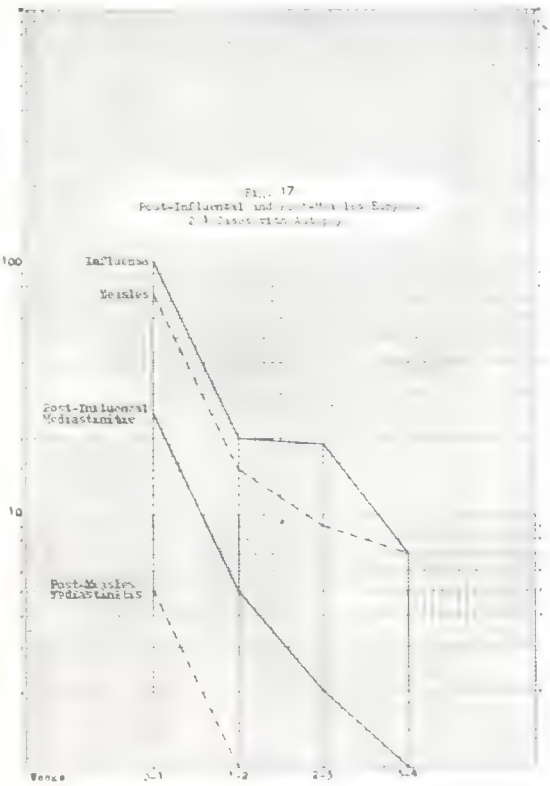


TABLE V. EMPYEMA; STREPTOCOCCUS INFECTION

		weeks
Mediastinitis	10	4
Bilateral pneumonia	5	4
Peritonitis	10	4
Pericarditis	15	4

lymphatic and blood vascular systems come into intimate relations with each other.

In conclusion, attention should again be directed to the fulminating character of the cases in which an infection of the mediastinal tissues was most frequently observed. Only those cases which died within the first 5 weeks after the inception of empyema have been included in the series studied. The incidence of mediastinitis declines rapidly in the successive weekly periods, terminating in two cases during the fourth week. If, however, all the cases associated with streptococcus which died more than 5 weeks after the recognition of empyema are gathered into a single group, it is found that infection within the mediastinum was found at autopsy associated with bilateral pneumonia and peritonitis in quantitative relations closely corresponding to those during the fourth week. The incidence of pericarditis, however, falls to less than one-half of the proportion maintained by the other conditions. The actual figures are given in Table V.

These later cases are too few in number, too variable as to the interval before death, and too incompletely recorded for a detailed analysis. It appears, however, justifiable to conclude that a general mediastinal infection is most likely to occur before the defensive reactions of the body are marshalled to impede dissemination of the infecting organisms, but that occasionally these defenses break down after a period of relative efficiency and that the course of events is then similar to that more commonly observed in fulminating cases, only less widely diffused.

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ROENTGEN DIAGNOSIS OF THE MORE IMPORTANT TUMORS OF THE LONG BONES

BY BERNARD H. NICHOLS, M.D.

MY attention was first called to the importance of the roentgen-ray diagnosis of bone tumors in 1917. Soon after our entrance into the world war I was assigned duty at Cornell University and there, under Major Frederick Baetger, we learned something of the limited views held by physicians concerning the interpretation of the pathology found in bone tumors. Several hundred physicians were prepared for X-ray work in the United States Army in a little over 1 year. We secured a remarkable collection of bone plates from the various hospitals of New York, representing practically all the types of bone tumors found in the literature. Many of these were accompanied by the history of the case, together with the pathological diagnosis after operation. From these we were able to make a very comprehensive study of the differential diagnosis of most bone tumors as depicted by roentgenograms.

It was surprising how much real diagnostic material could be obtained from many of these plates. The first impression gained from the observation of an X-ray plate of a bone tumor is simply one of bone destruction, of bone production, or of both, but many other aspects should be considered also, such as the location of the tumor, the condition of the cortex of the bone, the age and sex of the patient, the invasion of the soft parts, the point of origin, and the character of the destruction.

In order to interpret the value of these observations, a classification of bone tumors becomes necessary. This is best made by making four major divisions, under which each bone tumor may be classified according to its pathology. By this method the diagnosis in many instances may be either definitely made or limited to the possibility that the tumor in question is one of two or three types. In other words, diagnosis thus becomes a process of elimination. By this scheme bone tumors are classified by the following plan according to their origin: whether medullar or cortical; (2) whether or not they are characterized by bone production, by bone destruction or by both; the resultant condition of the cortex, whether expanded or destroyed; and (4) whether they are invasive or non-invasive in their growth.

CLASSIFICATION OF BONE TUMORS

I.
- a. Medullary
  - Periosteal sarcoma
  - Myositis ossificans
  - Exostoses
- b.

II.
- Periosteal sarcoma
- Myositis ossificans
- ture

III.
- a. Expanded
  - Enchondroma
  - Bone cyst
  - Fibroma
  - Carcinoma
- b. Destroyed

IV.
- a. malignant tumors
- b. all benign tumors

We shall be impressed by the ease with which bone tumors may be diagnosed roentgenographically by means of this simple classification. The first obstacle with which we are confronted is the fact that in certain

Fig. 1. Round cell sarcoma of ilium approaching sacro-iliac joint but limited in its extension by cartilage of joint.

Fig. 2. Tuberculous lesion of sacro-iliac joint showing extension of destructive process through the cartilage into the joint.

cases we may not be able to determine each of the points in this classification. For instance, in an advanced case we may not be able to determine the point of origin of the tumor or we may not be able to determine invasion, but usually two or more of these cardinal points may be learned from the pathology seen on the X-ray plate, and these will materially help in the process of elimination.

It is always possible to determine bone destruction and usually bone production as well. We must, however, remember that bone destruction is materially altered by surgical interference, as the removal of bone surgically and the disturbance of the periosteum with its consequent ossification changes the picture. Also trauma may do the same thing, as is shown in the healing of a bone cyst after pathological fracture. These points of diagnosis are not applicable to flat bones nor to vertebræ. The importance in many cases of seeking further aid is at once obvious.

What else may we learn from the roentgenogram? As stated above, we can always determine the location of the tumor; whether in the end of the bone, in the joint, or in the middle of the bone near the entrance of the nutrient foramen. This last location may be the deciding point in the diagnosis of carcinoma, which we know is always metastatic and is most often found near the point where the nutrient foramen enters the bone, while sarcoma is usually found in the end of the bone. Malignant tumors do not cross a joint, as cartilage seems to be a barrier to malignancy, so that a lesion involving both sides of a joint is always a benign process.

We can also determine whether the lesion is single or multiple. This point is often of great aid in the diagnosis.

The age of the patient can usually be quite accurately determined from the X-ray plate. This is an important observation because of the fact that sarcoma, while it may be found at any age, is most common during the periods from birth to the age of 40 years. Carcinoma, on the other hand, is seen most often after the age of 40; is extremely rare in

Fig. 3. Periosteal sarcoma of tibia.

children, and is only occasionally seen between the ages of 20 and 40.

Before discussing the analysis of the pathological findings in individual tumors, a brief consideration should be given to the development of bone tumors. A malignant tumor whose origin is in the medullary canal, develops by cell division and extends about equally in all directions; the growth is progressive and invades the cortex of the bone and the surrounding tissues, making an almost spherical tumor. This is in distinct contrast to infectious processes of bone which extend up and down the medullary canal, following the haversian canals and leaving areas of healthy bone or separating sequestra, thus making the lesion rather multiple in character. After the subsidence of the acute infectious process, marked new-bone formation is laid down at the periphery of the inflammatory lesion, thus producing a dense periosteitis and a thick cortex. This is both a reparative process and is nature's attempt at walling off extension of the lesion. In direct contrast to this protective process are the rapidly progressive malignant processes in which no abating of symptoms allows of

Fig. 4. [illegible] of trauma.

Fig. [illegible] months of X-ray therapy.

repair or of the limiting of the growth by new-bone formation.

The picture of benign bone tumors is again totally different from that presented by either malignant or infectious processes. Usually of medullary origin and slow of growth, the benign tumor gradually expands the bone and thins out the cortex. A small amount of new-bone formation at the periphery keeps the cortex intact. Also a thin dense line may be seen at the limit of the lesion in the medullary canal. These tumors are retarded considerably by resistance, consequently they tend to extend up and down the medullary canal, so that the growth presents a rather cylindrical contour.

These general considerations lead to a study of the pathological characteristics of the more important bone tumors.

Fig. 6. Syphilitic osteomyelitis of the humerus.

Fig. 7. Osteosarcoma of the humerus. Compare with Figure 3.

SARCOMA

Bone sarcoma may be of the round cell or spindle cell type; periosteal or osteosarcomatous in character; primary or metastatic in origin. We place giant cell sarcoma in the class of benign tumors from the fact that it seldom destroys the cortex of the bone and never metastasizes, although it has all the other characteristics of a true sarcoma.

Round cell sarcoma is a very malignant lesion with the following characteristics: The tumor is medullary in origin, contains no new bone, but shows a marked destruction in all directions. It breaks through the cortex of the bone, and invasion of the soft tissue results. These tumors may be found anywhere in bone but are usually seen in the ends of the long bones. Round cell sarcoma does not cross a joint, since as we have stated above the cartilage seems to be a barrier to its growth. Figure 1 illustrates a round cell sarcoma approaching a joint but limited by the cartilage on the side of the ilium. At the lower portion of this growth the whole bone has been swept away by the extension of the growth; but the sacral side of the joint is not involved. Contrast this with Figure 2, which shows a tuberculous lesion of the sacroiliac joint, in which the destructive process has attacked the joint itself and has destroyed the cartilage on both sides. Round and spindle cell sarcomata and tuberculosis are the only purely destructive lesions of bone which are unaccompanied by any new-bone production. When this type of pathological lesion is found, we are usually able to determine whether the lesion is malignant or benign, but it is difficult to know whether the growth is a sarcoma or a carcinoma. But differential diagnosis is aided by the fact that a sarcoma of this type most often occurs before 30 years of age, while carcinomata are metastatic and occur later in life. A combination of the roentgenological findings with the history will, in most instances, lead to a correct diagnosis.

Spindle cell sarcoma presents most of the characteristics of round cell sarcoma, but is

Fig. 8. Giant cell sarcoma of the upper end of the humerus of 15 years' duration.

and thinning of cortex.

less invasive, and the roentgenogram presents the appearance of some limitation, especially in the medullary canal where a slightly denser area appears at the periphery of the growth. These tumors do not metastasize as readily as do the round cell sarcomata. They may be mistaken for osteomyelitis in their early stages. In general, all the diagnostic points of round cell sarcoma apply equally to spindle cell sarcoma.

Periosteal sarcoma originates in the periosteum as the name implies. A striking characteristic of this type of tumor is the method of bone production, in which the new bone is laid down in striæ, perpendicular to the shaft. The deposit of new bone is entirely in the soft tissues and does not reach the bone proper (Fig. 3). The cortex may be destroyed later in the disease. These tumors are most often seen before 30 years of age, and like all malignant tumors they are invasive in character. These tumors, however, may be simulated very closely by some benign types of bone pathology, such as periosteal reproduction after trauma as by a blow on the tibia from a kick or severe fall. Dr. Bloodgood calls attention to the importance of the physical examination in these cases. Unlike sarcomata, the soft tissue is not indurated or swollen, but is freely movable over the tumor. Figure 4 illustrates this type of benign growth simulating a periosteal sarcoma. Figure 5 shows the same tumor after 4 months of X-ray therapy.

Syphilis also may simulate periosteal sarcoma, but in syphilis the new bone is usually

Fig. [illegible] Bone cyst in head of humerus with pathological fracture.

laid down parallel to the shaft, and if the characteristic lace-work formation is also present no mistake should be made (Fig. 6).

Osteosarcoma is usually cortical in origin. Bone production is pronounced and as in periosteal sarcoma the new bone is deposited in striæ perpendicular to the shaft, but unlike the latter in osteosarcoma, the new-bone formation is found within the tumor as well as in the invaded soft tissues (Fig. 7). In general, the degree of malignancy may be determined, to a considerable extent, by the amount of new-bone formation; the more malignant the type the more rapid the growth and in consequence the more limited the bone formation.

Bone destruction is seen early; the cortex is destroyed and the medullary canal is invaded.

The cortical destruction, the character of the new-bone formation, and the picture of invasion are the most important points in diagnosis.

Exostosis or osteoma need not be confused with sarcoma, as the former presents a definite outline with no semblance of invasions. Early in this disease it may be difficult to establish the diagnosis before the cortex is broken through. Osteomyelitis, cysts, or myelomata may all have to be ruled out. Osteomyelitis is usually accompanied by pain, while an initial chill with the clinical history of an acute infection and later redness and swelling of the soft parts establish the diagnosis. Myelomata and cysts expand the cortex, show no new-bone production and are quite regular in their outline. Their growth is slow as compared with the rather rapid development and usual early destruction of the cortex which are characteristic of osteosarcomata. Myelomata are multiple lesions. However, there is a type of osteosarcoma which arises from the periosteum and shows little involvement of the cortex, but it surrounds the bone presenting the appearance of an invasive tumor interrupted with areas of cartilage and bone.

CARCINOMA

Bone carcinoma is always metastatic and is medullary in origin. Most often it is seen at the middle of the bone at the point of entrance of the nutrient foramen. There is no bone production, only bone destruction. For this reason, carcinoma may be confused with tuberculosis, which also destroys bone without bone production, except when found in the shaft of the bone, these being the only

Fig. 11. Fibroma of phalanx.

two bone lesions of the pure destructive type. Tuberculosis, however, almost always involves a joint, usually having its origin in the cancellous end of the bone and rapidly extending to the joint. When it is found in the shaft of bone, it has all the characteristics of osteomyelitis. Carcinoma, on the other hand, never involves a joint. This fact aids materially in the diagnosis. The cortex is swept away without any attempt at expansion. The tumor extends equally in all directions. Carcinoma of bone is almost never found below the elbows or knees, and is essentially a disease of the later period of life. It is also the most common type of bone tumor found in the female sex after 40 years of age. This latter point aids us in the differential diagnosis between carcinoma and round cell sarcoma, the latter of which may be primary and is found at any age.

Fig. 4.—Osteoma of [illegible] side.

Fig. [illegible]

MYELOMA

Myelomata or [illegible] occur simultaneously at different locations in the osseous system. They are always medullary in origin. Two cases seen postmortem by MacCallum showed elevation of the cortex, erosion and protrusion of the growths. On roentgen examination these tumors should give first the appearance of expansion and later of destruction of the cortex. Pathological fractures and atrophy of the surrounding bone often result from these lesions. There is no blood picture which is characteristic of these lesions, but Bence-Jones bodies are always present in the urine. This latter finding together with the multiple lesions and the absence of metastases renders possible the diagnosis of this type of bone tumor.

GIANT CELL TUMORS

Giant cell sarcoma is a benign tumor usually medullary in origin. It does not produce new bone in its growth, but shows marked bone destruction. The cortex is intact, but is expanded. The origin usually is in the medullary canal but may be periosteal, in which case the growth is covered with a thin layer of bone. The tumor apparently grows equally in all directions and is usually found in the end of the long bones (Fig. 8). They are usually found after middle life. These

Fig. 11.—Exostosis of the lower end of femur.

tumors do not metastasize, but are single lesions, although they have a multilocular appearance and must be differentiated from bone cysts and fibromata.

Bone cysts are medullary in origin and produce marked bone destruction. They tend to extend up and down the medullary canal, expanding the cortex, and at the same time thinning it out, so that they present a cylindrical contour and often cause pathological fracture (Fig. 9). According to my experience, bone cysts are always single; that is, only one bone of the body is involved. They are usually multilocular, however, and found in the end of long bones. These tumors occur in early life. Figure 10 is an illustration of a bone cyst with pathological fracture.

Fibromata are rare. They destroy bone, are medullary in origin, and occur as single tumors. They thin out the cortex but do not destroy it. No new bone is formed, and the cortex does not expand. They show one single area of destruction and are not multilocular as are bone cysts (Fig. 11).

Chondro-osteoma and osteochondroma, as the names signify, present either a preponderance of cartilage over bone or of bone over cartilage. These tumors are either medullary or cortical in origin. They produce bone destruction with expansion of the cortex so that a cylindrical tumor results. They are usually multiple and are probably the result of the latent growth of bits of cartilage left in the bone during its development. Pathological fractures are common. Both bone destruction and bone production are present. These tumors are definitely limited and are readily diagnosed from a roentgenogram as benign lesions.

Fig. 12.—Myositis ossificans.

Osteomata are cortical in origin and show marked bone production without bone destruction. They are simply lawless growths of bone which sometimes contain bits of cartilage, which on the roentgenogram appear as areas of lesser density. They extend directly from the shaft or the body of the bone and may be found anywhere. They do not invade the tissues but push them aside to make room for their growth (Figs. 12 and 13).

Exostoses are bony growths from the cortex extending out from the body of the bone and pointing away from the nearest epiphysis. They are long and narrow and may have an osteoma on the end (Figs. 13 and 14). They are benign in character, and offer little difficulty in diagnosis.

Ossifying hæmatomata are cortical in origin and are not connected with the bone. They show calcification which presents the appearance of new bone in the tissue. The striæ are laid down parallel to the shaft of the bone. This lesion is not a tumor, but may have to be considered in making a differ-

ential diagnosis. The condition is the result of an injury with hæmorrhage beneath the periosteum, which limits the outline.

Myositis ossificans is a lesion in which new bone is present in the muscle where it is deposited parallel to the shaft of the bone (Fig. 15). It is easily differentiated from bone tumors. This lesion, as has been stated by Sir Robert Jones, is usually due to trauma as the result of which bits of periosteum have been torn off in an evulsion fracture, and have later produced new bone in the muscle.

TUBERCULOSIS

Tuberculosis of bone is usually of joint origin, if not, it is a definite osteomyelitis. Destruction of bone without bone production is the characteristic appearance. As we have stated above, the cartilage is attacked and both sides of the joint are involved, tuberculosis thus presenting a picture the opposite of that found in carcinoma or in round cell and spindle cell sarcoma. The cortex of the bone is swept away which is not the case with the benign tumors of bone in which only bone destruction is present.

There is, however, one type of tuberculosis to which careful consideration must be given, and that is *caries sicca*. This is a form of tuberculosis of the joints occurring after 40 years of age, and the characteristic of which [illegible] tissues about the joint, the areas of destruction [illegible] joint. The diagnosis is aided by the fact that although this condition is a joint lesion, yet there is present no swelling, hazin[illegible] fluid.

[illegible]

These conditions show marked periosteitis extending parallel to the shaft of the bone. In syphilis this may appear as the typical lacework periosteitis which is pathognomonic of lues. The cortex may be broken through at several points. The lesion usually extends [illegible] the bones, separating islands of healthy bone (Fig. 6). Sequestration is present in advanced cases. These points with the history of the case aid much in diagnosis. The Wassermann reaction is often negative in cases of bone syphilis, so that it cannot be relied on for diagnosis. If surgical intervention has destroyed bone or disturbed periosteum, this whole plan of diagnosis becomes useless.

It is my hope that these few classifications and groupings of pathological findings as used in the section of roentgenology in the Cleveland Clinic may be of some aid in the [illegible] tumors.

EMPHYSEMA OF THE SCROTUM THE RESULT OF DIVERTICULITIS OF THE SIGMOID WITH PERFORATION

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EXTRAVASATION of urine into the subcutaneous tissues of the perineum and scrotum is so often seen in traumatic surgery that it occasions little comment, but the introduction of air, either directly or indirectly, into these tissues is rarely observed. Fuller, in his book on genito-urinary diseases, quotes Verneuil as having made some observations on the latter condition, and divides it into two types; first, gas distention by air from wounds adjacent to the scrotum or connected with distant wounds communicating with the air passages, and second, gas distention due to the invasion of the tissues by gas-forming organisms; this type is obviously much more serious and more often fatal than the first type.

The urinary extravasations follow a very definite route, owing to the arrangement of the fascial planes in the perineum through which the urethra passes. Generally, in cases in which the urine infiltrates the tissues as a result of direct trauma applied to the perineum, the urethra is driven upward against the pubic arch and lacerated. The bulboperineal portion is the usual point of injury, and the relation of the rupture to the triangular ligament determines the course of the extravasation. This urogenital diaphragm, the base of which enters the central tendon of the perineum and the lateral attachments of which are the rami of the ischium, and pubis, is continuous with both the superficial perineal fascia and the deeper pelvic layer. Should this trauma rupture the urethra then posterior to the ligament, the extravasation must necessarily be backward and downward, while a break in front directs the course forward and upward infiltrating the tissues of the anterior part of the perineum and scrotum and even extending well up on the abdomen. That this usual route was followed in our case seems logical despite the fact that there was a communication between the sigmoid flexure of the colon and the urinary bladder, as operation verified. The patient was aware of having passed gas by the urethra, once several weeks before examination in the Clinic and once the night before operation.

Owing to peculiar anatomic arrangements it seemed highly improbable that gas had made its way into the bladder and thence into the subcutaneous tissues of the scrotum; that another perforation, or leakage from the same one had occurred and had burrowed through the peritoneum and under the fascial layers to emerge in front of the triangular ligament and infiltrate the adjacent subcutaneous tissues, seems the obvious deduction.

REPORT OF CASE

CASE A376337. Dr. F. L. A., age 46, registered at the Clinic November 11, 1921. He complained of pain and soreness in the left lower quadrant of the abdomen. The pain had appeared 3 years before and had been at first, sharp, shooting, and confined to the lower left quadrant, but later it radiated into the perineum and crossed the entire lower abdomen. The patient had been nauseated but had not vomited and had had only a slight rise of temperature, 100 being the highest. At the first attack there had been no tenderness to pressure, and residual tenderness had not been noted; the patient had been able to resume work at the end of 3 days. After this the attacks were intermittent for 8 months. He did not have a recurrence for about 2 years, when the attacks began to occur more frequently and with increasing severity. The pain increased so that 2 grains of morphia a day were required to control it. There had been no blood in the stools nor had constipation been a factor, although the patient complained of more uneasiness in the pelvis when the bowels were not loose and of considerable discomfort on defæcation. Pain and sense of pressure were usually quickly relieved by bowel movement. Six weeks before examination a new syndrome appeared which added greatly to his distress. He began to have frequency and burning pain on urination, especially at the end; this was greatly aggravated by exertion, even the movement of riding in an automobile. He had not found blood or gravel in the urine although constantly alert for one or both, and his previous history was entirely negative to any genito-urinary disturbance.

The patient's general physical examination was practically negative. His general appearance was

that of a robust [illegible] physical exercise. [illegible] mal weight was 215. The systolic blood pressure was 122, diastolic 80. The pulse [illegible] temperature 99.4°. The specific gravity of the urine was 1.015, the [illegible] blood cells 1, and pus 3. The combined phenolsulphonephthalein test was [illegible] one-half ounce residual urine. The leucocytes numbered 7,200, the [illegible] oglobin was 74 per cent.

The roentgenological diagnosis was obstruction in the sigmoid flexure. No definite conclusion could be reached from the proctoscopic examination. Digital examination of the rectum met an obstruction, principally on the right side about 3½ inches from the anal orifice; the examining finger could not reach beyond it. The prostate was enlarged [illegible]ly. It [illegible] examination although from the roentgen-ray findings, the history and the rectal examination a [illegible] sigmoid attached to the bladder causing a severe [illegible] cystitis and producing an intermitt[illegible] [illegible] explored through a [illegible] diameter was located deep in the pelvis and identi[illegible] entirely inflammatory. It was attached to the left lateral wall of the bladder far down in the pelvis; it [illegible] could be demonstrated. A loop of the ileum was

[illegible] It was not removed for fear [illegible] with the sigmoid, and a resection of the entire mass seemed too formidable an undertaking to carry out in one stage. The lumen of the colon was obstructed, causing it to baloon throughout its left half, thus adding an additional argument against an initial resection. Consequently a preliminary colostomy was made with the hope that sidetracking the growth would permit a recession of the inflammatory process and reduce the obstruction. This, while prolonging the convalescence and making a two-stage operation, would bring the risk to a minimum. Accordingly a loop of the descending colon was fastened into the upper angle of the wound after a modification of the Mayo method, leaving the decision of future operation open.

Postoperative course. The immediate convalescence was uneventful. The patient complained very little of gas pain and altogether was not very uncomfortable. The colostomy had not been opened. On the eighth day, the patient complained of quite severe gas pain and suddenly in the afternoon noticed that his scrotum began to swell painlessly, but at a noticeable rate. Within 3 hours it was about 30 centimeters in diameter, and air crackles were quite distinct. It seemed certain that the condition was in no way connected with urinary extravasation since the patient voided with ease and the physical appearance and feel of the tissues were characteristic. The fact that a fistula was known to exist between the bladder and bowel did not explain the condition, since it offered no anatomical method of bringing about an emphysema. There was no extension on the abdomen, which, however, was considerably balooned with gas, and on which peristalsis could be noted. The loop of bowel in the colostomy wound was cut across, thus immediately relieving the abdominal distention and sidetracking the fæcal and gas currents. There was no further increase in the emphysema of the scrotum but it was exceedingly slow in returning to normal; 2 weeks elapsed before its reduction was complete. Except for a somewhat aggravated cystitis, the patient was none the worse for the unusual complication. He returned home with the open colostomy and with the advice to wait several months before having the second stage of his operation carried out.

POSTTRANSFUSION REACTIONS

Alterations in Blood After Ether Anesthesia and After Bone Injuries

By I. C. Levine, M.D., F.A.C.S., and Harold N. Segall, M.D.

THE history of blood transfusion previous to the present era, which really began with Crile's epoch-making work in 1906 (10), consists of several short periods during which the usefulness of transfusion as a therapeutic measure was enthusiastically endorsed, and long intermissions during which it was considered a hazardous procedure. Based upon a number of fortunately successful cases and upon attractive but for the most part erroneous theories, the legitimate importance of blood transfusion took on the aspect of a "cure-all" and a life-saving device in all serious diseases; and, therefore, came to be used in as great, if not a greater variety of conditions, as may be found in a modern list of indications. Indeed, its sphere of usefulness was extended to the soul, for Cardamus in 1556 advocated that people hopelessly immoral should be transfused with blood of those strongly moral (Jones, 18). A comparison between the practice of transfusion before the present era and its practice with modern methods can only excite wonder and a certain degree of admiration for the courage and skill of our forebears, who, in total ignorance of aseptic methods and working with inferior instruments and technique, were able to obtain some encouraging results. But these deficiencies in their knowledge may be taken to account for both their courage and for the failures, which, at the end of each successful period, stamped transfusion as a dangerous operation and eliminated it from practical therapeutics, until in some future generation interest in it was again revived and success, enthusiasm, failure, and resultant condemnation were again repeated.

The investigations and clinical applications of blood transfusion reported by Crile (10 and 11) excited much scientific interest throughout the entire world. Since then, the technique has been greatly perfected by the introduction of the Lewisohn [illegible] Lindeman and Unger (44) methods and their modifications. Landois in 1875 was the first to discover that the dangerous results following transfusion were due to the fact that the fresh serum of an animal of one species could dissolve the red cells from an animal of another species. The researches of Landsteiner (21), Jansky (17), Hektoen (15), Ottenberg (31), and Moss (28), explained the nature of the dangerous, often lethal, post transfusion reactions, and made it possible to test for the compatibility of donor's and recipient's bloods previous to transfusion. Furthermore, fair and rational estimation of results obtained from transfusion in various conditions has eliminated many cases in which the measure is useless, and has thus diminished the number of failures. The true indications for transfusion have thus been placed in greater relief; and hence its usefulness is now better appreciated.

Blood transfusion must, therefore, remain permanently as a therapeutic measure of highest value and very great importance.

Whereas the technique of transfusion is now very efficient, and its sphere of usefulness is now well understood, the problem of eliminating posttransfusion reactions has been successfully dealt with only in its grosser phases. For, in spite of pretransfusion tests for compatibility of donor's and recipient's bloods, posttransfusion reactions continue to occur. From our observations, and from an examination of the literature, we have come to the conclusion that inaccurate testing cannot account for all the reactions, but that they occur very frequently, even after the bloods have been properly matched and found suitable.

Alterations in Recipient's Blood After Ether Anesthesia

The attention of one of us (Levine) was attracted to a hitherto unreported cause of reaction, by a number of experiences with

transfusion for postoperative replacement of blood. In such cases, if the possible necessity of transfusion is foreseen previous to the operation, a suitable donor may be chosen and held in readiness, to be used at any time during or after the operation. If the necessity of transfusion is perceived only during or after the operation, and if the group of the patient is known, a suitable donor of known group may be obtained; but if the patient's group is not known, possible donors may be quickly summoned, the bloods of the donor and recipient tested, and a suitable donor chosen. Some operators who do transfusions are satisfied, in cases of emergency, to choose the nearest relative as a donor and proceed to perform the transfusion without previous testing of bloods; although this latter procedure is unscientific and unsafe to the patient, it is permissible in the most extreme cases of emergency.

Case 1. In September, 1919, at the Royal Victoria Hospital, it was found necessary to do a transfusion on Mr. H., 60 years old, after he had undergone a radical Kraske operation which lasted 2½ hours. Anæsthesia in this case was begun with gas and oxygen and continued with ether. Almost immediately after the operation some blood was withdrawn from the patient and centrifugalized. The serum, which had a pinkish tinge—probably due to some hæmolysis—was matched with the red cells of the donor, this patient's 24-year-old son, a well-built man in good health; marked agglutination occurred within 30 minutes after the test had been set up. Twenty-four hours later some blood was again taken from the patient, and the serum obtained was plainly straw-colored without any pinkish tinge. The test was repeated with the red cells from the same donor; there was no agglutination evident, even after 12 hours' incubation at 37°C.

Case 2. In June, 1920, the necessity for transfusion after operation was deemed possible in the case of Mrs. A. C., who was to undergo a laparotomy for gall-bladder disease. The direct test was performed, matching her serum with her husband's red cells and *vice versa*. No agglutination occurred. The operation lasted 2 hours, ether being used as the anæsthetic. Profiting by the experience of Case 1, some blood was withdrawn from the patient immediately after the operation. The serum obtained by centrifugalization presented a pinkish tinge. The test was repeated and marked agglutination of donor's cells by recipient's serum was observed within the first half hour after the test had been set up. Twenty-four hours later the test was again made with fresh serum (which lacked the pinkish tinge), and no agglutination occurred. Eleven days after the operation 400 cubic centimeters of citrated blood, taken from her husband, were transfused. No untoward symptoms followed.

Case 3. On November 7, 1921, the blood of Mrs. A. K., age 41, was tested by matching it with cells of several donors, and a suitable donor was found. On November 8, Doctor Archibald performed the Lilienthal operation for resection of carcinoma of the œsophagus. Anæsthesia was begun with gas and oxygen and continued with ether. The operation lasted 2½ hours. At the end of this time, and while the patient was still well under the anæsthetic, some blood was withdrawn, and the serum obtained by centrifugalization of the blood presented a pinkish tinge, which was not present in the serum obtained previous to the operation. The test was repeated and marked agglutination of donor's cells by recipient's serum occurred within 15 minutes after the test had been set up. Twenty-four hours later the test was repeated; a clear straw-colored serum was obtained and there was no agglutination. No transfusion was done in this case.

The cases of transfusion for postoperative replacement of blood which we were able to find in the literature were not reported with the necessary details of the duration of anæsthesia, the color of the centrifugalized serum and the results of tests before and after anæsthesia; so that they cannot be used for the purposes of this discussion.

The observations made on these three cases point to a definite phenomenon, namely, that a long operation in which ether is used as the anæsthetic alters the patient's serum as regards its hæmoagglutinin properties. Furthermore, this change is not a permanent one but disappears during the first 24 hours after the operation, i.e., just about the time when the patient has recovered from the effects of the ether anæsthesia.

Several hypotheses may be considered in attempting to explain the nature and cause of these phenomena. It may be possible that lipoids liberated from the tissues and taken up by the blood are responsible for the agglutination immediately after prolonged anæsthesia, and that when these lipoids have been excreted from the blood, the serum again behaves as before the operation. Another possibility is, that the organic products of surgical shock may be responsible for the temporary alteration in the hæmoagglutinins of the blood. Then, again, the ether that is present in the blood, by its own action,

or by substances or effects which it produces in the blood may be the cause of the change. This latter hypothesis is supported by the presence of a pinkish tinge in the serum obtained by centrifugalizing blood withdrawn immediately after prolonged ether anæsthesia—this pinkish tinge being due to hæmolysis of red cells most probably caused by the ether present in the blood.

Furthermore, Professor Oertel has suggested to us that ether being a lipoid solvent, the alteration in the colloidal state of the blood which it produces is most probably the cause of the changed hæmoagglutinin and hæmolysin phenomena which are themselves also colloidal in nature. Professor Bruère corroborates this opinion from his experience with the Wassermann reaction. He has observed that the presence in the blood of substances which alter its colloidal state interfere with the reaction. Thus blood withdrawn several hours after a meal, and containing products of digestion is unreliable for the purposes of the Wassermann test. Indeed, he has found that if blood has been taken during or immediately after ether anæsthesia, the proper results are not obtained.

A more complete discussion of the nature and cause of these phenomena, we postpone until we will have completed the investigations that we are carrying on. Our observations have, however, taught us a valuable practical lesson, namely, that in practicing postoperative transfusion for replacement of blood, especially in cases following prolonged ether anæsthesia, it is essential to match the patient's serum with the donor's red cells and *vice versa*, after the operation; and that it is necessary to wait at least 24 hours before taking the sample of blood for serum from the patient. This necessitates postponing the transfusion for at least 24 hours, during which time the patient may be benefited by glucose or saline injections.

ALTERATIONS IN BLOOD AFTER TRANSFUSION

Certain conditions, such as the anæmias, hæmaphilia, purpura, leukæmia, and others often call for more than one transfusion.

In 1913, Ottenberg, Kaliski and Freedman, (32), from experiments on animals, concluded that multiple transfusions from a given donor to a given recipient caused the development in the latter's blood of specific agglutinins and hæmolysins against the donor's cells which were originally not present.

Ottenberg and Libman (33), in 1915, were the first who from clinical observations pointed out the danger of posttransfusion reactions following the second, or subsequent, transfusions from a given donor to a given recipient, even when the test previous to the first transfusion proved the bloods to be compatible, and, moreover, even when no reaction followed the first transfusion. These same authors emphasized "the necessity of doing tests again if transfusion is repeated even if the same donor is used." They reported that they had "seen several instances in which a patient developed new agglutinative and hæmolytic powers toward the blood cells of a donor to whom he had not originally been agglutinative or hæmolytic. In one of these cases, a young man, suffering from hæmophilia, a first transfusion of 50 cubic centimeters by the syringe method was followed by no reaction whatever, and the tests showed absence of hæmolysis or agglutination. A month later, an identically similar transfusion of the same amount of blood was followed by an immediate reaction, consisting of partial collapse, nausea and vomiting, generalized urticaria, violent headache and hæmaturia. Blood obtained from patient and donor a few days after this occurrence, showed that the serum of the patient was now strongly agglutinative to the cells of the donor. It was not determined whether the agglutinin present was due to the patient having changed his group (a hitherto undescribed occurrence), or to the development of a new immune iso-agglutinin."

In 1917, Minot and Lee (34), reported three cases of reactions after repeated transfusions, "in one case, the third transfusion, using the same donor as in the first transfusion, was followed by a marked reaction which hastened death. The donors and recipients in all cases belonged to the same groups." Another very striking example was reported by Thalhimer, (43) in the case of a boy aged 6 years, suffering from purpura.

By the direct method of testing donor's and recipient's bloods, the father was found to be a suitable donor and 300 cubic centimeters of citrated blood were transfused; a slight reaction consisting of a transitory rise in temperature to 103° followed [illegible] after the transfusion. About 3 weeks later, using the same donor without again testing the bloods, a second transfusion was given, when 150 cubic centimeters of citrated blood were injected. The patient developed tingling of face, legs and feet, then burning of feet. There followed flushing of face, the skin became diffusely peppered with pin point hæmorrhagic spots. With the appearance of pallor the pulse became almost imperceptible. The transfusion was stopped, and very soon the pulse acquired good volume, but it remained very rapid (about 140). About half an hour after the beginning of the reaction the patient was in fairly good condition and was returned to his room. Shortly afterward, however, he had a severe chill, temperature rose to 102.6° and he vomited undigested food. He complained of marked difficulty in breathing which was irregular, deep and jerky. Pain in the abdomen was so severe that the bed clothes had to be lifted off because their weight intensified the pain. About 2 hours after the transfusion, the patient voided about 6 ounces of very dark hæmoglobinuric urine. Ten hours later he again voided similar, but somewhat lighter urine, and 4 hours after this his urine was pale yellow, but it still contained a considerable number of hæmoglobin-tinged, coarsely granular casts which were very abundant in the first two specimens and which did not disappear until the third day after transfusion. At no time were red blood cells found in the urine.

Our attention to this phenomenon, of a reaction after the second transfusion from a given donor to a given recipient, was first attracted by the following two cases in the series of transfusions performed at the Royal Victoria Hospital:

Case 1. Mr. X age 45, suffering from pernicious anæmia, was given 500 cubic centimeters blood from a tested suitable donor on January 27, 1919. No noticeable clinical reaction followed. On March 7, 1919, without again testing the donor's and recipient's bloods, the patient was given 700 cubic centimeters blood from the same donor as was used for the first transfusion. Two hours after the completion of this second transfusion, the patient had a violent chill, during which his temperature rose to 105° F. The lips and mucous membrane of the mouth became œdematous, breathing was labored and the pulse small and thready. A specimen of urine passed soon after the onset of these symptoms showed the presence of a small amount of blood. The acute symptoms gradually disappeared; 2 days after the transfusion a slight degree of jaundice became evident, but this feature also diminished until it became hardly noticeable when the patient was discharged in good condition about 3 weeks after the transfusion.

Case 2. M. K., female, age 21, admitted for ruptured ectopic gestation with large hæmorrhage. On September 21, 1920, she received 540 cubic centimeters of blood from a tested suitable donor. Immediately after the transfusion the patient experienced a chilly sensation which lasted for about half an hour. No other untoward symptoms or signs occurred. She was operated upon on September 22, and a second transfusion was performed on October 15, using the same donor as for the first, depending upon the compatibility of the bloods as determined by the test of recipient's serum against donor's cells and *vice versa*, performed before the first transfusion. Moreover, no doubt as to the compatibility of the bloods was entertained, since nothing unusual occurred after the first transfusion that could have aroused suspicion. The second transfusion consisted of 550 cubic centimeters of blood. Almost immediately after the operation was completed a violent reaction began. The patient experienced a severe chill, with a rise in temperature from 97° to 105° within 15 minutes, and cyanosis, labored breathing, a thready weak pulse which could not be felt during rigor, and vomiting of a considerable amount of blood-stained material quickly followed. She also complained of severe dull pain in the lumbar region. Blood oozed from the mucous membranes about the mouth, especially from the gums. About 7 hours after the transfusion she vomited a considerable quantity of dull, red fluid and clotted blood. There was also some slight but continuous hæmorrhage from rectum and vagina, and blood was found in a catheter specimen of urine. The very acute symptoms, namely, the chill and general signs of shock, gradually disappeared but the patient remained quite sick, vomiting of blood-stained food, oozing of blood from buccal mucous membrane and from rectum and vagina continued until October 20, and then suddenly ceased. The vomiting gradually diminished in frequency from five to six times a day to once a day, but it was not until October 30, seventeen days after the transfusion, that it ceased completely. On October 20, the patient's face appeared puffy. She was given an intravenous saline of 30 ounces on October 27, and following this she improved rapidly until November 6, when she was discharged in good condition.

On the other hand, it must be borne in mind that not every transfusion in which a given donor is used two or more times for a given recipient, is necessarily accompanied by a reaction. Butsch and Ashby (8) report 26 cases in which the same donor was used twice for the same recipient, in 16 of which no reaction followed either transfusion, while in 7 only one transfusion was accompanied

by reaction, and in the remaining 3 a reaction followed both transfusions. Meleney, Stearns, Fortuine and Ferry (48), however, in a review of 280 transfusions, concluded that subsequent donation of blood by a given donor to a given recipient, tends to increase the frequency of reaction in direct proportion to the number of transfusions. Thus the percentage of reactions of various degrees in their series was as follows:

	Percentage
After the first transfusion	[illegible]
After the second transfusion	70
After the third transfusion	[illegible]
After the fourth transfusion	[illegible]

The latter authors, from a study of the same series of 280 transfusions, pointed out the interesting fact, that repeated transfusions, from several donors to a given recipient also tend to increase the frequency of reaction in this recipient. Reactions of various degrees occurred in the following percentages:

	Percentage
After the first transfusion	60
After the second transfusion	59
After the third transfusion	[illegible]
After the fourth transfusion	68
After more than four transfusions	74

McLure and Dunn (25), in an excellent analysis of 150 transfusions found that "in the patients for whom many transfusions have had to be done, it became more and more difficult to find donors whose blood would match that of the patient. A donor may match perfectly early in the series of transfusions and later be found unsuitable. . . . It is, therefore, most important that the bloods be matched before each transfusion." Several years later Bowcock corroborated these observations, and went even further by stating that "in certain cases of pernicious anæmia which have been repeatedly transfused, there comes a time when suitable donors are no longer to be found, and when this point is reached, no further attempt to transfuse these patients should be made."

All these observations together point to the definite phenomenon which must now be accepted as an incontestable fact, namely, that the original iso-hæmoagglutinin and iso hæmolysin properties of the recipient's blood are altered as the result of the addition of donor's blood. What the nature of this alteration is, remains an open question—a problem for study.

There is a very close resemblance between the symptoms and signs of a reaction following a second transfusion from the same donor and the symptoms and signs of anaphylactic shock, as is very well illustrated by the four cases cited above. This fact has led all observers to suggest that the posttransfusion reaction may be anaphylactic, the first transfusion being held responsible for the causation of a hypersusceptibility of the recipient's serum against the donor's cells. This, however, does not make the explanation much clearer for the phenomenon of anaphylaxis is itself very inadequately understood, and explanations of its exact nature are as yet at the stage of hypothesis.

It is important to know whether the reaction is associated with any change in the group of the recipient. All those who do transfusions can contribute to the elucidation of this point by testing the recipient's blood before and after transfusion, by both the direct and the indirect methods. Recently, we found that after a donor had been used twice for the same recipient (although the recipient remained in the same group, Moss 11), her serum caused slight agglutination of the donor's cells, whereas in previously performed direct tests no agglutination was observed. We do not attach any great importance to this single observation, since a large series of data would be necessary to allow of any definite conclusion on this phase of the problem.

The investigations of Sellards and Minot (41) and of William Bayliss (1) eliminate the possibility that the presence of free hæmoglobin in the blood is the main cause of posttransfusion reactions.

The possible influence of a particular donor on the frequency of reactions in the patients to whom he gives blood was investigated by Meleney, Stearns, Fortuine and Ferry (48) in their series of six donors, each of whom was used twelve times or more. One man who donated blood sixteen times was associated with reactions in the recipients on fourteen occasions (88 per cent), while another who

Seventeen transfusions caused only seven reactions (47 per cent). The largest number of donations made by one man was 36, and in his case there were 28 reactions (78 per cent). There is, therefore, considerable difference between donors in their tendency to produce reactions.

The relatively great frequency of milder degrees of posttransfusion reactions, consisting of a transitory rise in temperature, often associated with chills, tingling etc., and occasionally slight hæmoglobinuria, raises the question as to whether these reactions are only milder degrees of those severe ones which follow definite incompatibilities between donor's and recipient's bloods, or whether they are due to independent causes, as, for example, deficiencies in technique, influences of contact of donor's blood with foreign substances (Fenn, 14) during the operation, etc. From the investigations of Meleney (48) and his associates, of Drinker and Brittingham (13), and of Butsch and Ashby (8), it appears reasonable to include all reactions in one general category, as regards their causation.

It appears, therefore, that the most logical path of investigation into the exact cause of posttransfusion reactions lies within the broad field of immunology.

CONCLUSIONS

Although the exact nature of the reactions and their causes leave much room for study, the practical lessons to be learned from the above observations are quite definite and very valuable to the safe practice of transfusion:

1. The compatibility of the recipient's and donor's bloods must be determined prior to each and every transfusion.

2. No transfusion must be done during or within 24 hours after prolonged ether anæsthesia even when the donor has been found suitable previous to the beginning of anæsthesia.

3. Much depends upon the accuracy of the test. It is, therefore, preferable to do both the indirect test (Moss, 28) to determine the group of donor and recipient, and also the direct (Cooca, 9) test, to corroborate the compatibility of the bloods, thus checking up one test by the other.

In a very recent article Robertson and Rous (39) conclude that in cases of repeated transfusion it is necessary to test for auto-agglutination in the recipient's blood, and also point out that serum separated at 37° C. contains more agglutinins than that separated at room temperature, whereas agglutination is more marked at room temperature than at 37° C.

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*These articles contain extensive bibliographies.

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VOMITING AND DISTENTION AFTER LAPAROTOMY LESSENED BY THE SUBSTITUTION OF RUBBER ENVELOP PADS FOR GAUZE

Influence of Ether, Morphine, and Rectal Therapy

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THE primary object of this study was to find out what differences, if any, in postoperative emesis and intestinal distention existed between laparotomized cases in which rubber envelop pads were used and those in which gauze pads were used.

The operations were intra-abdominal and, with a few exceptions (namely, appendectomies, intestinal resections, and ventral herniæ), were performed upon the pelvic organs of the female. In many cases, plastic work of the vaginal canal was done in combination with the abdominal work. The character of the operations was, therefore, practically the same. Simple appendectomies, when done through the McBurney or right rectus incision, were not included for the reason that here little use was made of pads, and consequently but a limited amount of trauma was inflicted on the peritoneum of the intestines.

It was originally proposed to study 800 laparotomized cases. In 400 of these, rubber envelop pads were used; in 400, gauze pads were used. The former cases were operated on between November 26, 1917, and January 13, 1920, and the latter between December 20, 1917, and July 15, 1920. But after completing the study in greater part, it was discovered that of the three operators who were credited with the use of gauze pads, one not infrequently used rubber pads, and, as it could not be determined in which cases the gauze pads were used, it was necessary to eliminate 34, making a study of 366 cases in which gauze pads were used, and 400 in which rubber pads were used. As this study was made primarily to determine the difference in action and influence of rubber and gauze used intra-abdominally with respect to postoperative emesis and distention, it was necessary to exclude all cases of general septic peritonitis, as emesis and distention are almost invariable sequelæ to this pathology.

The study was limited to the first 3 days of convalescence, because cathartics, which are usually administered on the fourth day, are not infrequently responsible for emesis, and because distention from operative causes, unless the result of sepsis, seldom extends beyond the third day.

The operative technique of one group of cases differs radically from that of the other in one particular only, namely, in the character of the abdominal pads used.

The postoperative care differed in several minor features, namely in regard to rectal therapy and the degree of tension of the abdominal binder. Pre-operative care was practically the same in all cases with respect to the amount of morphine and atropine administered before etherization.

The group in which rubber envelop pads were used will be designated as group 2; the group in which gauze pads were used will be designated as group 3. As the comparative study will be made with regard to the days on which emesis or distention occurred, these groups will be divided according to days. Classified according to this plan, it was found that the cases fall into eight divisions:

The first division includes those cases which did not vomit at any time during the first 3 days of convalescence;

The second division includes those cases which vomited the first day only (that is, the day of operation);

The third division includes those cases which vomited the first and second days only;

The fourth division includes those cases which vomited during the first, second, and third days;

The fifth division includes those cases which vomited the first and third days only;

The sixth division includes those cases which vomited the second and third days only;

TABLE I.—GROUP 1. NON-LAPAROTOMIZED. 300 CASES

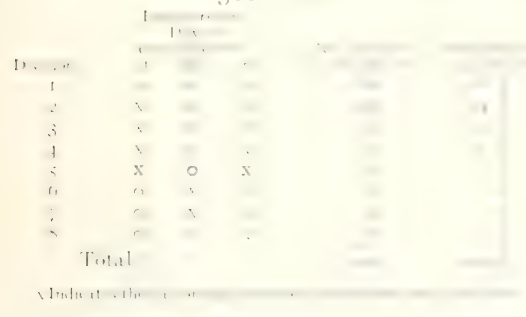
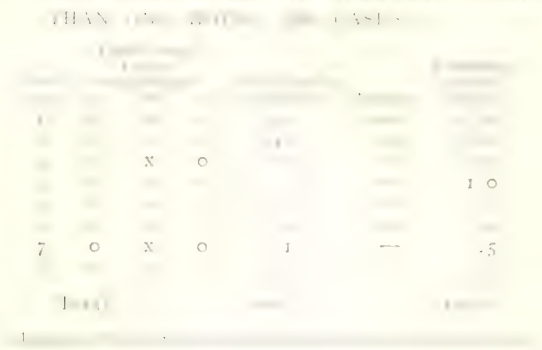


TABLE II.—GROUP 2. NON-LAPAROTOMIZED CASES, ETHER OPERATIONS MORE THAN [illegible] CASES



The seventh division includes those cases which vomited during the second day only;

The eighth division includes those cases which vomited during the third day only.

It was a simple matter to determine the frequency and duration of emesis in groups 2 and 3, but an analysis of them, with the object of determining why there were such great variations in emesis with respect to days, and of differentiating between emesis, the result of ether, and emesis, the result of other causes, was found impossible until the limits of the influence of ether, morphine, and other factors were known. Therefore, it became necessary to study another group of cases, those in which all causative factors arising from peritoneal invasion were eliminated. This group will be known as group 1, the non laparotomized cases (Table I).

Of the 300 cases constituting group 1, 80, or 26.7 per cent, did not vomit during the first 3 days of convalescence; 208, or 69.3 per cent, vomited during the first day only, and 12, or 4 per cent, vomited during and after the first day or only after the first day.

To facilitate the study of group 1, I have divided it into subgroups *a* and *b*. Subgroup *a* consists of those cases which were under the influence of ether more than 1 hour (Table II). Subgroup *b* consists of those cases which were under the influence of ether less than 1 hour (Table III). The former includes 200 cases with extreme limits of time—1 hour to 3 hours 10 minutes; the latter includes 100 cases with extreme limits—15 minutes to 1 hour.

An analysis of subgroup *a* with respect to the time of etherization, and the time limit of postoperative emesis shows:

The average time of etherization in the 50 cases constituting division 1 was 1 hour, 40 minutes;

The average time of etherization in the 140 cases constituting division 2 was 1 hour 35 minutes;

The average time of etherization in the 10 cases constituting divisions 3, 4, 5, 6, 7, and 8 was 1 hour 43 minutes.

A further analysis shows that of the 50 cases constituting division 1, etherization lasted 2 hours or more in 12 cases with an average time of 2 hours, 24 minutes, and that in the remaining 38 cases of this division etherization lasted between 1 and 2 hours, with an average time of 1 hour, 22 minutes.

That of the 140 cases constituting division 2 etherization lasted 2 hours or more in 30 cases with an average time of 2 hours, 10 minutes, and that in the remaining 110 cases of this division etherization lasted between 1 and 2 hours with an average time of 1 hour, 24 minutes.

This analysis shows

First, that the average time of etherization in the cases which did not vomit at any time was not shorter but 5 minutes longer than in the cases which did vomit during the first 24 hours only

Second, that the average time in the 12 cases under ether 2 hours or more, which did not vomit, was 14 minutes longer than that of the 30 cases under ether 2 hours or more but which did vomit during the first 24 hours.

Third, that the average time of the remaining 38 cases etherized between 1 and 2 hours

TABLE III.—SUBGROUP *b*. NON-LAPAROTOMIZED CASES. TIME OF OPERATION LESS THAN ONE HOUR; 100 CASES

Division	Emesis (Vomited)			Number in each division	Average time	Percentage
	1st day	2nd day	3rd day			
1	O		O	30		30.0
	X		O	68	30	
	X	X	O			O
	X	X	X	1	—	1.0
	X	O	X	O		
	O	X	X			
	O	X	O	1		1
		O	X		—	O
Total				100		100.0

which did not vomit was 2 minutes less than that of the 10 cases etherized between the same hours but which did vomit.

As there are only 10 cases in the remaining divisions which vomited irregularly with regard to days, it is difficult to make a satisfactory comparative study of them. We find, however, that the emesis which occurred in these cases after the first day, was the result, in the majority of cases, of such causes as food and medicine administered immediately before emesis.

Two of these cases, therefore, might be classified in division 1; eight of them might be classified in division 2. Under this readjustment the average time of division 1 would be 1 hour 37 minutes, and that of division 2, 1 hour 36 minutes.

These findings would suggest that the element of time as a causative factor in postoperative emesis is not so important as we have heretofore been led to believe.

An analysis of subgroup *b* with respect to the time of etherization, and the time limit of postoperative emesis shows:

The average time of etherization in the 30 cases constituting division 1 was 27 minutes;

The average time of etherization in the 68 cases constituting division 2 was 30 minutes;

The average time of the remaining 2 cases constituting divisions 4 and 7 was 22 minutes.

A further analysis shows—

That of the 30 cases which constituted division 1, etherization lasted from 30 to 55 minutes in 13 cases, with an average time of 39 minutes, and that in the remaining 17 cases

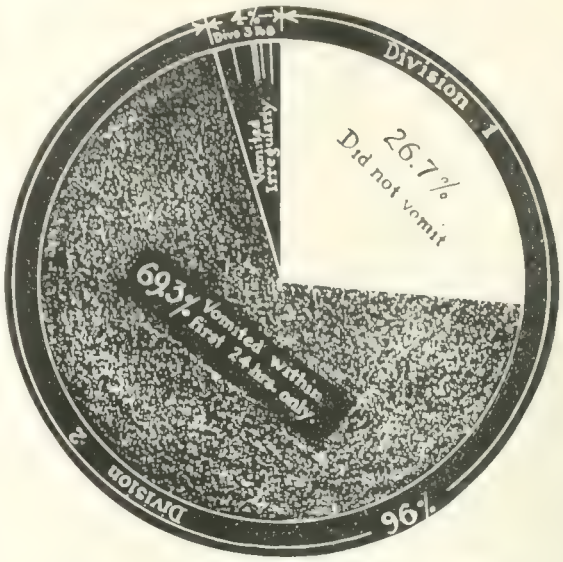


Fig. 1. Group 1. Non-laparotomized cases.

of this division etherization lasted less than 30 minutes;

That of the 68 cases which constitute division 2 etherization lasted, in 38 cases, from 30 to 57 minutes, with an average time of 37 minutes. In the remaining 30 cases of this division, etherization lasted less than 30 minutes, with an average time of 20 minutes.

This analysis shows—

First, that the average time of etherization, in the cases which did not vomit at any time, was 3 minutes shorter than that in the cases which did vomit during the first day.

Second, that the average time in the 13 cases under ether between 30 and 55 minutes, which did not vomit, was 2 minutes longer than that in the 38 cases under ether the same length of time but which did vomit during the first day.

Third, that the average time of the remaining 17 cases etherized less than the 30 minutes, which did not vomit, was only 1 minute less than that of the 30 cases etherized the same length of time but which did vomit during the first day.

Of the two cases which vomited irregularly with regard to days, one vomited on each of the 3 days and was etherized 30 minutes. The other vomited on the second day only and was etherized 15 minutes. Accidental

causes were determined immediately preceding the emesis which occurred in these cases on the second and third days. The first case might, therefore, be classified with division 2, and the second case with division 1; but as these cases constitute so small a part of the entire group and, as the length of their respective etherization could alter but little the percentage of the divisions, they might be disregarded entirely.

It would, therefore, seem that regarding the relationship between the duration of etherization and frequency or infrequency of emesis, there is no fixed rule.

TO WHAT EXTENT DOES MORPHINE ADMINISTERED HYPODERMATICALLY AFTER OPERATION ENTER AS A CAUSATIVE FACTOR IN POSTOPERATIVE EMESIS?

An analysis of the divisions in group 1—non-laparotomized cases—shows the following:

Of the 80 cases with no vomiting, we find that 40 received morphine during the first day; as no emesis occurred on this day, these 40 cases which received morphine acted, with respect to emesis, as did the remaining 40 cases which did not receive morphine. The total amount of morphine given these 40 cases was a fraction less than 16 grains or an average of 0.4 of a grain.

On the second day, we find that 26 cases received morphine. As no emesis occurred on this day, the 26 cases which received morphine acted in no way differently with respect to emesis than did the remaining 53 cases which received no morphine. The total amount of morphine given these 26 cases was a fraction less than 8 grains or an average of 0.3 of a grain.

On the third day, we find that 10 patients received morphine. As no emesis occurred on this day, these 10 patients acted, with respect to emesis, as did the remaining 69 cases in which no morphine was administered. The total amount of morphine given these 10 patients was 3 grains or an average of 0.3 of a grain.

Of the 208 cases vomiting on day of operation (division 2), we find that 134 cases received morphine during the first day. As emesis occurred on the first day in all cases of this division, the remaining 74 cases vomited independently of the possible influence of morphine acting as a causative factor in emesis. Of the 134 cases which received morphine, 53 vomited before its administration, 49 vomited after, and 32 vomited before and after. The total amount of morphine given these 134 cases was 52 grains or an average of 0.4 of a grain.

On the second day, we find that 70 patients received morphine. As no emesis occurred on the second day of this division, these 70 cases which received morphine acted in no way differently, with respect to emesis, than did the remaining 129 cases which received no morphine. The total amount of morphine administered to these 70 cases was 20 grains or an average of 0.3 of a grain.

On the third day, we find that 40 patients received morphine. As no emesis occurred on the third day of this division, these 40 cases acted in no way differently, with respect to emesis, than did the remaining 168 cases which received no morphine. The total amount of morphine administered to the 40 cases was 11 grains or an average of 0.3 of a grain.

It would, therefore, appear from this analysis that of the 174 cases not vomiting at all or vomiting the first day only (divisions 1 and 2), which received morphine during the first day, only those cases which vomited after its administration, namely 49, and those cases which vomited before and after, namely 32, totaling 81, could have been influenced by morphine with respect to emesis.

As the average amount of morphine (i.e., 0.4 of a grain) administered to these 81 cases which vomited was no greater, but identical, to the average amount given to the 93 cases which did vomit, and as the average amount (i.e., 0.3 of a grain) administered on the second day to the 105 cases and on the third day to the 50 cases were identical, it would seem reasonable to conclude that the amount of morphine administered hypodermatically after operation exerted but a minor influence, if any, as a factor in postoperative emesis.

Of the 12 cases, constituting 5 of the remaining 6 divisions, we find that 9 cases received morphine during the first day and three did

not. Of the 9 cases, 8 vomited on that day and 1 did not. Of the 8 cases, 2 vomited after, and 6 vomited before and after, the administration of morphine. The case which did not vomit received a larger dose of morphine during the first day than did any of the cases which vomited. The total amount of morphine given the 8 cases which vomited was 4 grains or an average of 0.4 of a grain. Of the 3 cases which received no morphine on the first day, 1 vomited seven times, and 2 did not vomit.

Of the 7 cases which received morphine on the second day, we find that 5 vomited and 2 did not. Of the 5 cases which vomited, the cause of emesis in 4 could be traced to food or medicine administered by mouth. To the remaining 2 cases which did not vomit, the smallest individual amount of morphine was administered. Of these cases, 1 received the largest individual amount of morphine administered on the second day to any of the 12 cases constituting 5 of the remaining 6 divisions. The total amount of morphine administered to the 7 cases was 1.7 grain or an average of ¼ grain.

On the third day, we find that 3 cases received morphine. Of these only 1 vomited. This is the case previously noted as having received the largest amount of morphine on each of the first 2 days without emesis following. But on this, the third day, it received the smallest amount of morphine administered during the 3 days. There is every reason to believe, however, that emesis did not occur then as the result of morphine but as the result of the administration of magnesium sulphate which it immediately followed.

It would therefore seem that, regarding the relationship between the amount of morphine administered and the frequency or infrequency of emesis, there is no fixed rule.

While a very considerable number of individual cases could be related to sustain both conclusions formed by the previous study of averages regarding the relationship between ether and emesis, and morphine and emesis, it has been deemed undesirable to include these as in the study of individual cases, idiosyncrasy to drugs, which is an indeterminable factor, must enter.

IS THERE A FIXED RELATIONSHIP BETWEEN THE AMOUNT OF ETHER AND THE TIME OF ITS ADMINISTRATION?

It is to be regretted that the amounts of ether administered to the cases in group 1—non-laparotomized cases—were not sufficiently often recorded to permit of an exact estimate of the average amount administered per hour.

In subgroup *a*, those over 1 hour, there were 93 cases recorded with an average amount per hour of 176 cubic centimeters; in subgroup *b*, those under 1 hour, there were only 15 cases with amount of ether recorded, averaging per half hour 135 cubic centimeters. This comparison would make it appear that the average amount of ether administered is greater during a short anæsthesia than during a long one.

There was noted in the hands of only one anæsthetist a somewhat constant relationship between the two elements—the amount of ether and time of administration—but in this instance the number of cases was too few to be of value in forming a conclusion.

TIME LIMIT OF POSTOPERATIVE EMESIS AND THE LIMIT OF THE INFLUENCE OF ETHER WITH RESPECT TO EMESIS

Our immediate concern in this last analysis of group 1—non-laparotomized cases—is in regard to the limit of postoperative emesis and the predominant causative factor of emesis. As peritoneal trauma is not present in this group, it offers the best opportunity to study the limit of influence of any element, common to all groups, which might enter in causative relationship to emesis.

Such causative factors of emesis as food and medicine administered by mouth, acidosis, gastric accumulations, etc., act occasionally and may be considered accidental, but ether in the blood is the only possible factor which may be considered as constant.

Though ether as a possible factor is constant, one or more of the accidental factors may at times act independently or with it; therefore, it is not always possible to determine when emesis is the result of a single factor. A fairly accurate conclusion may, however, be arrived at in determining the predominating causative element of emesis in

this group by an analysis of the duration of emesis with respect to hours and a study of immediate or accidental causes.

If in a very large percentage of cases, the limit of postoperative emesis should fall within a period during which certain accidental factors are not usually present, this fact would be suggestive of the predominating influence of the factor known to be constant.

An analysis of group 1—non-laparotomized cases—shows that 80 cases, or 26.7 per cent, were not influenced with respect to emesis by any probable causative factor; that in 208 cases, or 69.3 per cent, emesis occurred during the first 24 hours only, and that in but 12 cases, or 4 per cent, did emesis occur after the first 24 hours.

In the 208 cases which vomited during the first day only, there doubtless existed more than one causative factor of emesis, but whatever they were and how many there may have been, their limit of influence did not exceed 24 hours. However, of the possible factors, ether alone was constant; therefore, it would seem reasonable to consider it the dominant factor in the causation of emesis during this period. Further, that, as the limit of emesis in these 208 cases did not exceed 24 hours, we may reasonably suppose that the limit of the influence of ether with respect to emesis does not exceed the first 24 hours.

Of the 12 cases in which emesis occurred after the first day, accidental causes, such as food and medicine by mouth, were discovered on the second and third day in 9; in the remaining 3 cases no immediate or accidental cause of emesis was determined. Of the 9 cases, 2 did not vomit on the first day, and 7 did. Because of the fact that accidental causes of emesis were determined after the first day in these cases, the former might be included in division 1 and the latter in division 2. If so considered, the total number of cases which vomited during the first day only, and from other than known accidental causes, would increase from 208, or 69.3 per cent, to 217, or 72.3 per cent. In the remaining 3 cases in which no accidental cause was discovered to account for emesis occurring after the first 24 hours, the limits of emesis were as

follows: first case, 26 hours after operation; second case, 30 hours after operation; and the third case, 39 hours after operation. The emesis which occurred 39 hours after operation in the third case was the only emesis which occurred in this case during the entire time of convalescence.[1]

A list showing the rating of the anæsthetists who administered ether more than 10 times is given in Table IV.

Anæsthetists' numbers 1, 2, and 3, though showing a comparatively high percentage of cases which did not vomit, had fewer cases by less than half than numbers 4, 5, and

One of the group, namely, number 7, showed a much higher percentage of cases vomiting than the others. This single instance raises the question regarding the individual skill of the anæsthetist as a factor in limiting emesis, but the rating of no anæsthetist can be determined under 50 or 100 cases.

Ether was administered to the remaining 19 cases by 6 other anæsthetists.

CONCLUSIONS REGARDING NON-LAPAROTOMIZED CASES

1. In 300 successive non-laparotomized cases, etherized, over 26 per cent escaped vomiting altogether; nearly 70 per cent vomited only in the first 24 hours, and 4 per cent vomited irregularly.

2. The length of etherization has no relationship to postoperative emesis with respect to frequency or days of occurrence.

3. The influence of morphine administered hypodermatically after operation is, with respect to emesis, practically nil.

4. The dominating fact in the causation of emesis when the peritoneum of the intestines

Fig. 2. Group 2. Cases in which rubber envelop pads were used.

Fig. 3. Group 3. Cases in which gauze pads were used.

TABLE V.—GROUP 2. LAPAROTOMY WITH RUBBER ENVELOP PADS; 400 CASES

Divisions	Emesis record Days of convalescence 1st	2nd	3rd	No. of cases in each division	Percentage in each division
1	0	0	0	108	27.0
2	X	0	0	179	44.7
3	X	X	0	50	12.5
4	X	X	X	29	7.3
5	X	0	X	14	3.5
6	0	X	X	10	2.5
7	0	X	0	10	2.5
8	0	0	X	4	1.0
Total				400	100.0

x Indicates the day or days on which one or more emesis occurred.

TABLE VI.—GROUP 3. LAPAROTOMIZED CASES WITH GAUZE; 366 CASES

Divisions	Emesis record Days of convalescence 1st	2nd	3rd	No. of cases in each division	Percentage in each division
1	0	0	0	46	12.6
2	X	0	0	148	40.5
3	X	X	0	71	19.4
4	X	X	X	65	17.7
5	X	0	X	19	5.2
6	0	X	X	5	1.4
7	0	X	0	6	1.6
8	0	0	X	6	1.6
Total				366	100.0

x Indicates the day or days on which one or more emesis occurred.

is not traumatized is ether and the limit of its influence is 24 hours.

A Comparative Study of the 400 Laparotomized Cases (Group 2) in Which Rubber Envelop Pads Were Used and the 366 Laparotomized Cases (Group 3) in Which Gauze Was Used

Emesis during first three days

An analysis of laparatomized cases in which rubber envelop pads were used—group 2—shows the following:

Of the 400 cases constituting group 2, 108 cases, or 27 per cent, did not vomit during the first 3 days of convalescence; 179 cases, or 44.7 per cent, vomited during the first day only; 50 cases, or 12.5 per cent, vomited during the first and second days only; 29 cases, or 7.3 per cent, vomited on each of the 3 days; 14 cases, or 3.5 per cent, vomited on the second and third days only; 10 cases, or 2.5 per cent, vomited on the second day only; and 4 cases, or 1 per cent, vomited on the third day only.

An analysis of laparotomized cases in which gauze was used—Group 3—shows the following:

Of the 366 cases of group 3, 46 cases, or 12.6 per cent, did not vomit during the first 3 days of convalescence; 148 cases, or 40.5 per cent, vomited during the first day only; 71 cases,

Fig. 4. Group 2. Four hundred cases of which [illegible] or 96.5 per cent, did not distend; 14, or 3.5 per cent, did distend.

Fig. [illegible] Group [illegible] did distend.

or 19.4 per cent, vomited during the first 2 days only; 65 cases, or 17.7 per cent, vomited on each of the 3 days; 19 cases, or 5.2 per cent, vomited on the first and third days only; 5 cases, or 1.4 per cent, vomited on the second and third days only; 6 cases, or 1.6 per cent, vomited on the second day only and 6 cases, or 1.6 per cent, vomited on the third day only.

INTESTINAL DISTENTION

A comparative study of the two groups shows that in group 2, some form of distention occurred in 16 cases. Of these, 4 were recorded as "distended" and 12 as "slightly distended." As 2 were recorded as "gastric distention" the number of cases of intestinal distention in this group was 14, or 3.5 per cent. Three cases distended on 2 successive days; no case distended on 3 successive days.

In group 3, there were 47 cases recorded as having had some form of distention; 33 of these were recorded as "distended" or "considerably distended" and 14 as "slightly distended." No cases were recorded with "gastric distention." Therefore, the number of cases with intestinal distention in this group was 47, or 13 per cent. Seven cases distended on 2 successive days, and 1 case distended on 3 successive days.

It may be of interest to note the difference of distention occurring in the corresponding divisions of the two groups as shown in table.

TABLE VII.—DIFFERENCE OF DISTENTION

[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	2.8	[illegible]	[illegible]
[illegible]	8.0	3	[illegible]
4	[illegible]	4	[illegible]
5	[illegible]	5	[illegible]
[illegible]	[illegible]	[illegible]	40.0
7	0	7	33 0
[illegible]	[illegible]	[illegible]	[illegible]

Our interest centers in the comparative difference in the 4 first divisions of the 2 groups, as the last 4 divisions constitute only 8 or 9 per cent of their respective groups, and are too small to influence materially conclusions drawn from the first 4 divisions; but as a matter of information, it might be noted that in the 4 last divisions of group 2, no distention occurred as contrasted with 16.6 per cent in the corresponding divisions of group 3.

It will be noted that there is a marked increase in percentage between divisions 2 and 3, and 3 and 4 of each group and an equally

striking contrast of difference in divisions 3 and 4 of group 2 and the corresponding divisions of group 3. The increase in percentage between the second divisions of each group corresponds with the increase in the duration of emesis in each respective division, namely two successive days of emesis in division 3 and 3 successive days of emesis in division 4. Also the difference in percentage in the same divisions of the two groups is equally striking and shows that some influence, causative of both emesis and distention, occurred to a greater degree in one group than in the other.

Our previous analysis of group 1 showed that such a difference could not be attributed to the length of time ether was administered, to the amount of morphine, or to the character of operation. To what then can such a difference be due?

The only factor common to both groups 2 and 3 and not found in group 1, which might be considered as causative of both emesis and distention, is peritoneal trauma; but in division 3 of group 2, we find distention in 8 per cent of cases as compared to 15.5 per cent in the corresponding division in group 3, and 12.5 per cent emesis in the division 3 of group 2 as compared to 19.4 per cent in the corresponding division of group 3. In division 4 of group 2, we find distention in 10.3 per cent of cases as compared to 20.1 per cent in the corresponding division of group 3 and 7.3 per cent emesis in division 4 of group 2, as compared to 17.7 per cent in the corresponding division of group 3.

This analysis shows that the common causative factor, which prolonged the time or duration of emesis and increased the percentage of distention, influenced both groups, but this is true to a lesser degree in one group than in the other, leading us to the conclusion that, as in divisions 3 and 4 in group 2, we have a markedly lessened per entage in both emesis and distention than in group 3; and as in group 2, the procedure adopted to keep the intestines out of the pelvis was less traumatizing than that used in group 3, a lesser degree of intestinal peritoneal trauma occurred, resulting in less emesis and distention in group 2 than in group 3.

MORPHINE

A comparative study with respect to morphine shows that in group 2 there were 17 patients who received no morphine during the first, second, and third days of convalescence. These were classified with respect to operations as shown in Table VIII.

TABLE VIII. NO MORPHINE GIVEN IN FIRST THREE DAYS; GROUP 2

Retroversion	5
Supravaginal hysterectomy	5
Adnexal operations	3
Myomectomy	1
Exploratory	1
Separation of adhesions	1
Resection of ileum	1
Total	17, or 4.2 per cent

In group 3, there were 9 patients who received no morphine during the first 3 days of convalescence. These were classified with respect to operations as follows in Table IX.

TABLE IX. NO MORPHINE GIVEN IN FIRST THREE DAYS; GROUP 3

Retroversions	2
Supravaginal hysterectomy	2
Appendix	1
Exploratory	2
Myomectomy	2
Total	9, or 2.4 per cent

It will be seen that practically 50 per cent more of cases received no morphine on the first 3 days of convalescence in group 2 than in group 3.

The total amount of morphine used in group 2 was 330 grains, or an average of 0.82 grain during the first 3 days of convalescence.

The total amount of morphine used in group 3 was 347 grains or an average of 0.95 grain during the first 3 days of convalescence.

These analyses show that in group 2 not only did a much greater number of individual cases pass through the first 3 days of convalescence without receiving morphine than in group 3, but that each day there were many more cases in group 2 than in group 3 which received no morphine, also that the total number of grains used in the 400 cases of group 2 were considerably less, i.e. 17, than the total number of grains used in the 366 cases of group 3.

In the first 4 divisions of each group, the average amount of morphine administered

TABLE X. COMPARISON OF RESULTS WHERE MORPHINE IS USED AND WHERE IT IS NOT

AMOUNT OF MORPHINE ADMINISTERED ON THE INDIVIDUAL DAYS

Group

1st day	165 grs.	average	gr.
2nd day	118 grs.	average	gr.
3rd day	44 grs.	average	gr.

Group 3

1st day	1[illegible] grs.	average	gr.
2nd day	1[illegible] grs.	average	gr.
3rd day	48 grs.	average	gr.

CASES RECEIVING NO MORPHINE ON THE INDIVIDUAL DAYS

Group 2

1st day	[illegible] cases	or	per cent
2nd day	96 cases	or	per cent
3rd day	237 cases	or	per cent

Group 3

1st day	11 cases	or	per cent
2nd day	64 cases	or	per cent
3rd day	176 cases	or	per cent

was greater in division 4 than in the other divisions. The question may arise as to whether the extended duration of emesis in this division (namely emesis on each of the 3 days) was the result of a larger average amount of morphine administered in this division than was administered in the other divisions. But it will be remembered that it was established by the analysis of group 1 that morphine *per se* (postoperative) does not occasion emesis.

It is, therefore, evident that the increased amount of morphine administered was due to an increase in amount and extent of pain. This increase in the amount of pain in the laparotomized groups was the result of an element not found in the non-laparotomized, i.e., peritoneal trauma; and it is presumably this element that not only increased the amount of pain, but extended the duration of emesis.

The Influence of Rectal Therapy on Postoperative Emesis; Its Comparative Use in Groups 2 and 3

Saline, bicarbonate of soda, glucose solutions, and hot water administered per rectum immediately before the termination of operation

When saline, bicarbonate of soda, glucose, or hot water is administered *per rectum* immediately before the termination of an abdominal section, what influence, if any, have they in lessening or preventing postoperative emesis?

In group 2 no rectal therapy was used immediately before the termination of operation.

In group 3 there were [illegible] cases, or [illegible] per cent, in which some form of rectal therapy was used immediately before the completion of operation.

The solutions were administered as follows:

Saline solution	[illegible]
Bicarbonate of soda	[illegible]
Glucose, 5 per cent solution	[illegible]
Hot water	[illegible]

When the comparative records of groups 2 and 3, with respect to emesis, are recalled, the above analysis brings into serious question the efficacy of rectal therapy, if it does not conclusively prove that the effect of such therapy with regard to preventing or modifying postoperative emesis is nil.

Saline, bicarbonate of soda, and glucose solution administered per rectum in the form of "drips" after operation (Murphy and Harris)

The same question may be asked regarding the influence of these solutions upon postoperative emesis in the form of "drips" as was asked regarding the administration of these solutions in quantity *per rectum* immediately before the termination of the operation.

In group 2, we find that the Murphy drip was used in 2 cases and the Harris drip in 5 cases: total 7 cases, or 1.7 per cent; in 1 of these 7 cases the "drip" was used 2 days successively, or 0.2 per cent.

In group 3, we find that the Murphy drip was used in 68 cases and the Harris drip in 13 cases: total 81 cases, or 22.1 per cent; in [illegible] of these cases the "drip" was used 2 days successively and in 9 cases 3 days successively, or a total of 8.7 per cent of cases in which the "drip" was used in successive days.

This analysis would lead us to practically the same conclusion as previously reached regarding the relationship of emesis to rectal therapy when used at the termination of operation; but whatever influence postoperative rectal therapy in the form of "drips"

may exert in preventing emesis, it is entirely the result of its action in stimulating peristalsis, thereby lessening intestinal distention, to which emesis at times is due.

TIME OF ETHERIZATION AND ITS RELATION TO POSTOPERATIVE EMESIS

A study of the laparotomized groups 2 and 3 with respect to the relationship between time of etherization and postoperative emesis cannot be made with the same satisfaction as the non-laparotomized group (group 1), because of the introduction in the laparotomized groups of the element of peritoneal trauma.

However, a study of the first four divisions of groups 2 and 3 (divisions which constitute collectively 91.5 per cent and 90.2 per cent of their respective groups) corroborate the finding in the study of group 1 with respect to the relationship between the time of etherization and the duration of postoperative emesis—namely that the element of time *per se*, has little or no influence as a factor in extending the duration of postoperative emesis.

It is self-evident that the influence of time in division 1 of groups 2 and 3 could have had no possible bearing upon the question of emesis in this division, as no emesis occurred in this division of either group.

In comparing division 2 of groups 2 and 3, we find that there is a difference of only 1.1 per cent of cases which were etherized two or more hours and a difference of only 1 per cent of cases which were etherized less than 2 hours.

The difference in percentage is here so little and the difference in percentage with respect to emesis is so small, namely 4 per cent, that this division may be left out of consideration in our analysis.

In division 3 of group 2, we find that there was 36.9 per cent of cases which were anæsthetized 2 hours or more as compared to 18.3 per cent in the corresponding division of group 3; and in division 4 of group 2, we find that there was 41.3 per cent of cases which were anæsthetized 2 hours or more as compared to 24.6 per cent in the corresponding division of group 3.

Here it will be seen that though the percentage of cases, which were under ether 2 hours or more in divisions 3 and 4 of group 3, was smaller than in the corresponding division of group 2, yet the percentage of postoperative vomiting respecting days in these divisions of this group was larger than in the corresponding divisions of group 2, i.e., 12.5 per cent as compared to 19.4 per cent and 7.3 per cent as compared to 17.7 per cent.

In division 3 of group 2 we find that there was 63.1 per cent of cases which were anæsthetized between 1 and 2 hours as compared to 81.7 per cent in the corresponding division of group 3; and in division 4 of group 2 we find that there was 58.7 per cent of cases which were anæsthetized between 1 and 2 hours as compared to 75.6 per cent in the corresponding division of group 3.

Here it will be seen that though the percentage of cases which were under ether between 1 and 2 hours of divisions 3 and 4 of

TABLE XI.—TIME OF ETHERIZATION IN THE FIRST FOUR DIVISIONS OF GROUPS 2 AND 3

DIVISION 1

Group 2—108 Cases

Two hours and over	36.9 per cent of cases
Less than 2 hours	63.1 per cent of cases

Group 3—50 Cases

Two hours and over	28.0 per cent of cases
Less than 2 hours	72.0 per cent of cases

DIVISION 2

Group 2—170 Cases

Two hours and over	28.7 per cent of cases
Less than 2 hours	71.3 per cent of cases

Group 3—148 Cases

Two hours and over	27.7 per cent of cases
Less than 2 hours	72.3 per cent of cases

DIVISION 3

Group 2—150 Cases

Two hours and over	36.9 per cent of cases
Less than 2 hours	63.1 per cent of cases

Group 3—71 Cases

Two hours and over	18.3 per cent of cases
Less than 2 hours	71.7 per cent of cases

DIVISION 4

Group 2—29 Cases

Two hours and over	41.3 per cent of cases
Less than 2 hours	58.7 per cent of cases

Group 3—65 Cases

Two hours and over	24.6 per cent of cases
Less than 2 hours	75.6 per cent of cases

DIVISION 2

Group 2

Retroversion..... 57
Adnexal and appendiceal..... 50
Exploratory.....

Exploratory.....

DIVISION 3

Group 2

Panhysterectomy.....
Adnexal and appendiceal.....

Supravaginal hysterectomy.....
Panhysterectomy.....
Myomectomy.....

Supravaginal hysterectomy..
Adnexal and appendiceal..
Myomectomy.....

Myomectomy..... 1

group 3 was larger than in the corresponding divisions of group 2, yet the percentage of postoperative vomiting respecting days in these divisions of group 3 was greater than in the corresponding divisions of group 2, as has just been

was a greater percentage of cases which were centage of postoperative vomiting respecting days than in the corresponding divisi there was a greater percentage of cases etherized less than 2 hours with a greater percentresponding divisions of group 2.

As it might be argued that the character of operation influences postoperative results with respect to emesis, it will be necessary to compare the character and number of operain the different di groups. As the first four divisions of groups of their

sufficient in number and percentage to determine the point in question.

A review of Table XII will convince one that all operations, except panhysterectomy, are in fair proportion, represented in the several divisions of the two groups. It is generally conceded that panhysterectomy is a grave operation and frequently followed by stormy convalescence, yet in divisions 1 and of group 2 (divisions in which emesis when occurring did not exceed 24 hours) there is 4.5 per cent of panhysterectomies as compared to nothing in the divisions in which vomiting extended to the second or third days, namely divisions 3 and 4. In the same divisions in group 3 there was 11.7 per cent as compared to 14.6 per cent. This table furnishes sufficient evidence, it would seem to show, that neither the character nor the gravity of the operation influences necessarily postoperative results regarding emesis.

CONCLUSIONS REGARDING LAPAROTOMIZED CASES

1. In 400 successive laparatomized patients, the use of rubber envelop pads resulted in freedom from vomiting in practically the same proportion as in the non-laparotomized patients.

2. Comparing nearly equal numbers of laparotomized cases under approximately the same conditions, this study demonstrates that to substitute the rubber envelop pads for gauze pads is to double the chance of escaping vomiting; to reduce 2 days vomiting by one-third; to cut 3 days vomiting 60 per cent; and to lessen distention by two-thirds.

3. The dominant factors in the causation of emesis in laparotomized cases are ether and trauma of the peritoneum of the intestines and while the influence of ether is only 24 hours, the influence of intestinal peritoneal trauma may extend to 3 days or more.

4. Less vomiting, less distention and less morphine shows less trauma to the peritoneum.

DESCRIPTION OF DIAGRAMS OF COMPARATIVE PERCENTAGES OF EMESIS IN THE THREE GROUPS

In the diagrams (Figs. 1 to 5), division 1 of each group, the division in which no vomiting occurred, is designated by white. Division 2 of each group, the division in which vomiting occurred on the first day only, is designated in gray; and the remaining 6 divisions are designated by black.

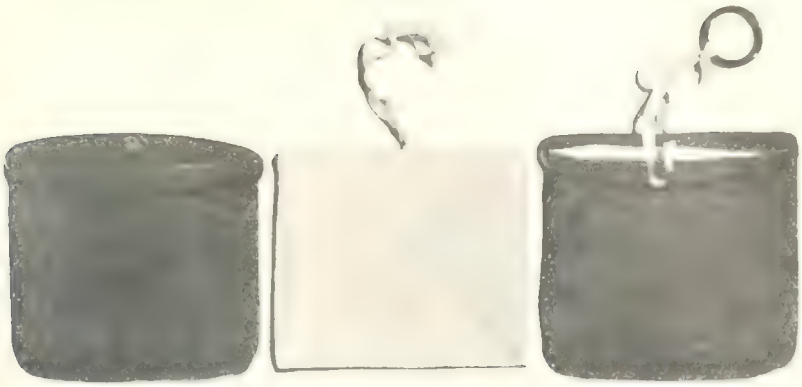
Comparing the divisions of group 2 (the group in which rubber envelop pads were used) with the divisions of group 1 (the non-laparotomized group) and with group 3 (in which gauze was used), we find that 27 per cent of group 2 division 1 did not vomit as compared to 26.7 per cent of group 1 (division 1) and 12.6 per cent of group 3 (division 1); therefore the number of laparotomized cases which did not vomit when rubber envelop pads were used was practically the same as did not vomit in the non-laparotomized work, but more than twice as many as did not vomit in the laparotomized group in which gauze was used.

We find that 44.7 per cent of group 2 (division 2) vomited on the first day only as compared to 69.3 per cent of group 1 (division 2) and 40.5 per cent of group 3 (division 2), therefore the number of cases of group 2 which vomited on the first day only is about one-third less than those of group 1, and a little more than those of group 3.

The most striking contrast in the 6 remaining divisions of the two laparotomized groups (groups 2 and 3) is in division 3 in which vomiting occurred on the first and second days only, and division 4 in which vomiting occurred on the first, second and third days. Here we find that when rubber envelop pads were used, 12.5 per cent vomited on the first and second days only as compared to 19.4 per cent when gauze was used; and that only 7.3 per cent vomited on the first, second and third days when the rubber envelop pads were used as compared to 17.7 per cent when gauze pads were used.

When the first 2 divisions of the three groups are considered collectively and contrasted with the remaining 6 divisions of their respective groups we find that—

First, the divisions 1 and 2 of group 1, divisions in which vomiting either did not occur or occurred only during the first day, constitute 96 per cent of the entire group as contrasted with 4 per cent of the remaining 6



Photograph showing rubber envelop, towel pad, and pad complete.

divisions in which vomiting occurred on and after the first day or only after the first day.

Second, divisions 1 and 2 of group 2, divisions in which vomiting either did not occur or occurred only during the first day, constitutes 71.7 per cent of the entire group as contrasted with 28.3 per cent of the remaining 6 divisions in which vomiting occurred on and after the first day or only after the first day.

Third, divisions 1 and 2 of group 3, divisions in which vomiting did not occur or occurred only during the first day, constitute 53.1 per cent of the entire group as contrasted to 46. 9 per cent of the remaining 6 divisions in which vomiting occurred on and after the first day or after the first day only.

Finally, group 1 determines the normal limitations of postoperative emesis with respect to time and is the standard for reference. In contrasting the other groups with group 1, it will be seen that group 2 approximates more nearly the standard than does group 3.

DESCRIPTION OF RUBBER ENVELOP PADS

The rubber envelop pads consist of two parts, an envelop and a pad. The envelop is made of thin rubber tissue and the pad is made of toweling material sewed together in such a manner as to give firmness and resistance. A loop of narrow tape 10 inches or more in length is sewed to the upper border of the cloth pad. When the cloth pad is placed in the envelop the loop of tape is passed through re-enforced holes located on the upper margins of the rubber envelop. By this means the envelop is closed and the pad prevented from escaping. An iron ring is attached to the free end of the loop of tape for the purpose of indicating the presence of a pad in the cavity. Three pads, two large and one small, constitute a set; the larger are 8 by 8 inches and the smaller 8 by 4 inches.

The rubber envelop pads are used intra abdominally in the place of gauze pads. Whether the patient is placed in Trendlenburg's position or not, the intestines should be pushed above the iliopectineal line before introducing the pads; the abdominal wall is then lifted with a retractor and one of the large pads folded lengthwise is placed in the region of the cæcum, the other is placed in the region of the sigmoid, and the smaller pad is placed perpendicularly in the middle of the true pelvis. The small pad is again used when the peritoneal layer of the wound is being sutured to keep the intestines from the field of work. It can be removed through a very small opening without traumatizing the peritoneum in the region of the wound.

Gauze pads should never be used in the envelopes as substitutes for towel pads as they do not furnish the required firmness and resistance to keep the intestines away from the field of operation.

CANCER IN THE CERVICAL STUMP: METASTASIS IN THE VERMIFORM APPENDIX

By ROBERT T. FRANK, A.M., M.D., F.A.C.S., Denver, Colorado

THE case here reported bears witness to the not infrequent misapplication of surgery: a supravaginal hysterectomy for fibroids of the uterus is performed and a beginning cancer of the cervix is overlooked. The unique site of metastasis in the vermiform appendix is the main reason for putting the case on record. Secondary cancer of the appendix vermiformis has regularly resulted by continuity from the cæcum, or by contiguity where the appendix has become adherent to malignant ovarian or other intraperitoneal neoplasms, or where a diffuse carcinosis of the peritoneum involved the appendix. None of these conditions obtained in the present instance.

C. D. colored, age 47, was admitted to the Denver City and County Hospital on September 20, 1921. She had had four children. It was difficult to obtain details beyond the fact that 1 year previously she had been operated upon for fibroids. The attending physician was later communicated with and informed me that "a supravaginal hysterectomy for fibromyoma of the uterus" had been done. Five months later the patient was treated with radium for cancer of the cervix, by some other physician.

On admission she complained of intolerable abdominal pain, vaginal bleeding, and foul discharge. There was the history of repeated attacks of obstipation closely approaching to complete obstruction.

The patient's condition was poor. The general physical examination proved negative. Below the umbilicus was a median abdominal scar, at the lower end of which was a small sinus such as is due to a retained suture or ligature.

Pelvic examination showed a lax vagina, the upper end of which ended in a crater formed by the cervix and bounded by the infiltrated adjacent lateral parametria. Until definite assurance of a previous hysterectomy was obtained, I believed that a small senile uterus was included in the cancerous mass which appeared adherent to the lower end of the abdominal scar. Rectal examination showed involvement and stenosis of the rectum just within reach of the palpating finger.

A specimen obtained from the crater was examined by Dr. W. S. Dennis and reported to be a squamous cell carcinoma without pearl formation.

On October first the patient developed symptoms of complete intestinal obstruction. These could not be relieved by any of the palliative measures resorted to (passing rectal tube beyond the stricture, stupes, physostigmin, etc.). With great reluctance, a colostomy was determined upon, but on opening the abdomen through the left rectus muscle the obstruction was found to be due to kinking of the lower ileum by adhesions to the median operative scar. The adhesions were divided, the hugely dilated and paralyzed loop emptied by means of enterotomy and the abdomen closed. The patient did not react and died within 1 hour after completion of the operation.

The autopsy was performed by Dr. Dennis who found no evidence of metastases in the liver, intestines, and peritoneal cavity. He removed the pelvic viscera *en masse* and most kindly placed them at my disposal.

Careful dissection showed a cervix to which were attached the stumps of the round ligaments, the uterine ends of the fallopian tubes, and the uteroovarian ligaments. The end of the abdominal sinus, mentioned in connection with the scar, ended in a small pocket containing a suture leading to the cervix.

The cancer had not broken into the peritoneal cavity, but had invaded the vesicovaginal septum, stenosed the rectum, and infiltrated the parametria (Fig. 1). Numerous retroperitoneal lymph glands (iliac and sacral) contained metastases.

The vermiform appendix, which was non-adherent and hung loosely over the pelvic brim, to cursory examination appeared normal (Fig. 1). On gross section the tip was found obliterated by a yellowish-white mass about 7 by 9 millimeters in size (Fig. 2).

The small tumor was submucous and intramuscular in situation. As can be noted in the low power, Figure 3, the proximal end shows the mucosa crowded out by the tumor which encroaches upon the lymphatic structures as well. The tumor alveoli are numerous and invade both the mucosa and deep musculature. In type the neoplasm is a squamous-cell cancer without pearl formation or cornification, (Fig. 4), and quite identical in morphology with the primary tumor. Sections of the mesenteriolum proved negative.

STUMP CANCER

Cancer developing in the cervical stump after supravaginal hysterectomy is now a well-recognized entity. The question as to whether total hysterectomy is, therefore, preferable to supravaginal amputation has given rise to controversy. Polak (1) recently has collected 256 cases, after hysterectomy for fibroids, from American sources alone.

He vehemently advocates total removal. Leonard (2), who in 1913, reviewed the huge material of Johns Hopkins Hospital found only two stump cancers, the first case appearing 18 years after a hysterectomy performed for pelvic inflammatory trouble. To these two cases may be added the one reported by Tyler (3) in 1915, as this patient also had the primary operation performed at Johns Hopkins. Only three cases from such an active service as that of Johns Hopkins are certainly few.

One of the main reasons for preferring supravaginal amputation to total hysterectomy is the smaller mortality of the former. The comparative mortality in experienced hands has been variously estimated as 2.6 per cent: 6.6 per cent (Botzong, 4) to 1.5: 2 per cent (Polak). Operation for uterine tumor is today performed by every casual operator. Unquestionably, routine complete hysterectomy would at once elevate the mortality rate greatly, and the number of non-fatal injuries to the bladder, ureter, and rectum would rise proportionately. Moreover in Leonard's table (loc. cit., 2.) one out of every four cases resulted, not after removal for uterine tumor, but after hysterectomy for pelvic infection. And, finally, Tyler (loc. cit., 3.) was able to gather 13 cases of carcinoma of the vaginal vault following total hysterectomy. From this it becomes apparent that even complete hysterectomy does not afford an absolute guarantee of subsequent immunity from cancer of the remaining part of the genital tract.

That, in almost half of Leonard's collected cases, some 60 in all, the cancer *appeared within one year* after the primary operation had been performed, is evidence of superficial, careless or unskilled examination in most instances. Only very rarely can the cancer be so small and insignificant as to escape searching scrutiny.

"Coring out" the cervical mucosa with the knife or cautery, at the time of operation, as advocated by Howard Kelly, may be of some service and does not add to the risk. Careful specular examination of the cervix before undertaking the operation, will guard against overlooking a beginning cancer in almost all

appendix hangs free over the pelvic brim. *Ov.*, ovary;

instances. Excisions from suspicious areas of the cervix should be submitted to the pathologist for examination before operating.

In view of the fact that even total excision of the cervix may be followed by cancer of the vaginal vault, that stump cancer occurs also after amputation for other conditions besides fibroids, and that the mortality of total hysterectomy is higher than that for supravaginal removal, it appears unwise to advocate total hysterectomy as a routine measure. More emphasis on the other hand should be placed upon minute and searching examination of the cervix before operation, in order that an already present cancer may not be overlooked. It is also proper to warn the patient that vaginal bleeding or discharge occurring at any time after the operation, even after years have elapsed (in Fehim's case, 7; the interval was 5 years in Leonard's case, 2, 18 years), should at once be reported.

[illegible] IN THE [illegible]

The subject is not mentioned in the textbooks of pathology (Aschoff, Kaufmann, Ziegler, Delafield and Prudden, etc.) Howard

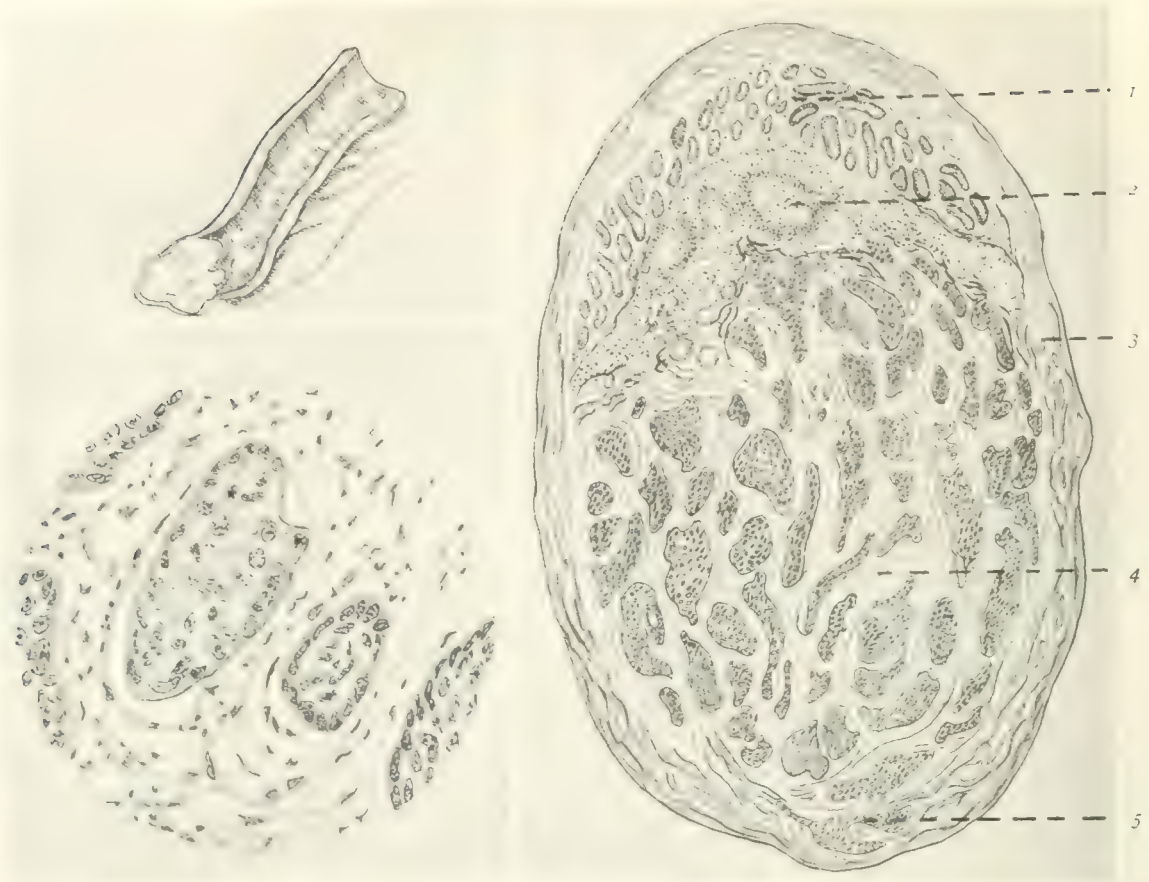


Fig. 2 (above, left). Vermiform appendix split open. Note obliteration of lumen at the tip by a solid growth.

Fig. 3 (at right). Oblique section through tip of appendix (x 16). *1*, Mucosa of appendix pushed away by the tumor; *2*, lymph center below the mucosa; *3*, muscular coats of the appendix; *4*, dense connective-tissue stroma separating the cancer alveoli; *5*, cancer alveolus invading the musculature.

Fig. 4 (below, left). Cancer alveoli of appendicular tumor (high power). The carcinoma cells show the same variations in size, shape, and tinctorial qualities as the cells of the primary cervical growth.

A. Kelly (6) in his book on *Appendicitis* says: "Secondary carcinoma is not uncommon, occurring most frequently by direct invasion, apparently more often by contiguity than by continuity of structure and occasionally by means of metastases." He cites extension from the cæcum, invasion by contiguity of an appendix adherent to malignant intraperitoneal growths, such as ovarian cysts, and involvement in the course of a general peritoneal carcinosis.

Search of the literature, especially that of the doubtful cases of so-called primary appendix carcinoma, has failed to show a case of cancer of the appendix, not primary, arising except by contiguity or continuity (7).

The reason that, in spite of its more than superficial resemblance to primary appendix cancer, of the type of the so-called "carcinoid" growths, I classify this small neoplasm appearing in the wall of a free appendix close to its tip (Fig. 2) as a metastatic growth is twofold. First, the morphology of the cervical growth is identical with that of the appendicular tumor (Figs. 3 and 4). Second, I agree with Eli Moschcowitz (8) who says: "In other respects, they (i.e. solid appendix cancers) differ histologically from other car-

cinomata. The cells are smaller and less atypical; the nuclei show little variation in size and shape, are less rich in chromatin and comparatively free from mitotic figures."

The only other interpretation possible is that the appendicular tumor is primary and that two coincident independent neoplasms occurred in the patient. Multiple primary tumors in the same host are by no means unknown (9). However, when two tumors agree exactly in their minute structure, and when dissemination through regional retroperitoneal lymphatic glands has already taken place, a common origin may be accepted as proved beyond a reasonable doubt.

SUMMARY

The case reported is one of stump cancer, noticed within 5 months after supravaginal hysterectomy for fibroids of the uterus. It is, therefore, fair to presume that the carcinoma was overlooked at the time of the operation.

Complete hysterectomy for fibroids of the uterus is not recommended as a routine measure, because of its increased mortality over supravaginal amputation.

Increased care in examining the cervix, *before* all operations for uterine conditions are undertaken, is enjoined and it is suggested that the patients after operation be warned to note and report bleeding or abnormal discharge.

A metastasis in the non-adherent appendix is reported as a unique site of secondary deposit from cervical cancer.

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THE ASSOCIATED PATHOLOGY OF GALL BLADDER DISEASE WITH A FURTHER PLEA FOR CHOLECYSTECTOMY[1]

By FRANK D. MOORE, M.D., F.A.C.S., Chicago

IN the last year, it would seem that interest in the gall bladder, its diseases, its complications, and its sequelæ, has been greatly stimulated, as there have been many contributions to the literature of that subject and much discussion of it in medical meetings, conferences, etc., and many and varied have been the ideas presented. The interest aroused and the discussion provoked are alone proof of the incompleteness of our knowledge and an argument for further investigation. Through all this mass of literature, however, and through all the various discussions, certain conclusions seem to be coming inevitably to the fore, namely:

The frequent occurrence of unsuspected gall-bladder disease in association with some other acute condition, the symptoms of which demand and bring about its discovery.

The frequent occurrence of latent gall-bladder disease as discovered accidentally in autopsies.

The discovery of infection or stones in the gall bladder with the subsequent eliciting of a history of long-continued obscure symptoms, usually referable to the stomach and often treated as such, over a long period, before a correct diagnosis is made.

The vast extent of the associated pathology of gall-bladder disease, including practically all of the pathology of the abdominal cavity.

The importance of early diagnosis, both because of the primary trouble and to prevent the occurrence of secondary pathology.

The importance of routine examination of the gall bladder, whenever possible, in any abdominal operation for other pathology.

The growing preference for cholecystectomy over cholecystostomy as the operation *par excellence*, because of the growing realization of its safety in the hands of a competent operator, as well as because of its undoubted superiority in preventing the recurrence of symptoms.

Of the etiology of diseases of the gall bladder, little has been added recently to our fund of knowledge, the idea of focal infections being at present very much in prominence, while other factors are—functional or secretory disturbances of the liver, typhoid bacilli, diminution of the flow of bile from the gall bladder, mechanical obstructions not sufficient to produce jaundice, etc. A number of cases are reported in the literature in which definite foci of infection have been found and demonstrated as probable etiological factors in ensuing gall-bladder infection. Among these, besides pre-existent typhoid fever, were several cases of marked pyorrhœa, septic tonsils and chronic discharge of pus from the nasal cavity. The source of these infections may be hæmatogenous, through the portal circulation, or through the lymphatics. Undoubtedly the field of the etiology of gall-bladder disease is large and probably less explored than that of the symptomatology, but with that field we are not dealing in this paper.

As to the symptomatology, it seems now to be a well-recognized fact that the majority of cases of latent gall stones have, in reality, not been latent at all, but the symptoms produced by them have not been referred to their correct source, but are variously ascribed to gastric disorders, indigestion, etc. Inasmuch as most of the beginning symptoms of gall-bladder disease are referable to the stomach, and are usually situated in the epigastrium, they are often ascribed to gastric ulcer, carcinoma, or simple disturbances of the secretory function.

Distress in the epigastrium, a sense of fullness and discomfort rather than actual pain, flatulency,—these are the beginning symptoms of latent gall-bladder disease and too often the ones least recognized as such. The later symptoms, those of pain in the right hypochondrium radiating to the back, nausea, vomiting, jaundice,—these are the signs of advanced disease, and with these signs we may expect to find no simple, uncomplicated condition, but always secondary pathology,

and it is with these secondary conditions, the so-called associated pathology of cholecystitis, that we wish to deal here.

And if we have found the field of symptomatology wide, we will find that of the associated pathology tremendous. In a previous paper I have discussed something of the associated pathology of appendicitis and that of the gall bladder is fully as wide-spread, as important and perhaps less often recognized.

Of the various pathological conditions associated together in the abdomen, probably the one most commonly found with gall-bladder disease is chronic appendicitis. From 30 to 40 per cent of cases have been found to be associated in this way. Often an acute attack of appendicitis is responsible for the discovery of gall-bladder disease, which might otherwise have remained indefinitely, giving occasional warnings of its presence, it is true, but for the most part unrecognized because of the vague and indefinite nature of its symptoms. As to whether the disease of the biliary tract is the primary condition, with a secondary infection of the appendix, or whether the reverse may be true, is, of course, not always demonstrable, but it would seem that in a great many cases the preponderance of evidence is for the most part in favor of the gall bladder as the primary focus of infection. The very chronicity of gall-bladder disease, with the slow growth of gall stones and the long periods of so-called "latency," tends to make this seem more probable. In either case it is undoubtedly true that the two conditions frequently co-exist, the one being discovered at operation for the other. Quite naturally, because of its greater tendency to acute exacerbations and because it is so easily diagnosed, even sometimes by the laity, the appendix is frequently the one first to force its way into the limelight and to demand immediate attention. Always, however, is there not the possibility and even probability that early recognition and treatment of the gall-bladder condition would have prevented the secondary infection?

With the occurrence of gall-bladder disease we get often the whole train of symptoms referable to inadequate functioning of the large bowel, stasis, intestinal intoxications, constipation, headaches, biliary migraine, etc. The association in this case is due, in part, to the original source of infection acting simultaneously upon various parts of the body, partly to mechanical forces, such as adhesions following gall-bladder infection, and also to disturbed flow of bile in the intestine.

As it is generally conceded that infection enters the gall bladder and ducts by way of the blood stream and lymphatics, rarely by direct extension, therefore it is to be expected that we should find gall-bladder disease usually coincident with some form or degree of hepatitis, exclusive of abscess-formation. This may be very mild, or it may amount to a true hepatic colic, with typical pain, fever, leucocytosis, and even degeneration of the liver-cells. The biliary type of migraine may be due to this form of infection. Undoubtedly the vast majority of these cases of associated hepatitis and cholecystitis are primary in the gall bladder.

While appendicitis is perhaps the most common abdominal pathology to be found and diagnosed in connection with cholecystitis, there is another condition of even closer connection and more important, because it is so directly dependent upon the condition of the gall bladder and because its treatment is the treatment of the gall bladder. This pathology is that of the pancreas. The close connection found between cholecystitis and pancreatitis is similar anatomically to that between cholecystitis and hepatitis. That is, the opening of the ducts of liver, gall bladder, and pancreas into one common duct, or a practically common duct, places both organs in a position whence they are peculiarly liable to infection from infected bile or where mechanical damage can easily be done from increased pressure and interference with the proper flow of bile. This connection is so close that it has been variously estimated that from 50 to 80 per cent of all cases of pancreatitis are due to or associated with cholecystitis, most frequently with gall stones. Some even go so far as to state that certain forms of pancreatitis, such as the chronic suppurative varieties and the acute hæmorrhagic form, are never found except in association with gall stones or infectious disease of the gall bladder

This secondary infection of the pancreas may be due to a variety of causes. An obstruction in the common duct may lead to increased pressure and a consequent forcing of bile into the pancreatic duct. This obstruction may be caused by stones, pressure from without, or spasm of the sphincter of the common duct. An infection may travel from the diseased gall bladder to the pancreas, moving along the lymphatics. A chemical change in the bile, due to bacterial action, or a high concentration of bile salts has been found to produce severe necrosis of the cells of the pancreas. Strong contractions of the gall bladder, as in biliary colic, may force bile into the pancreatic duct, with resultant acute pancreatitis. Another interesting explanation is that adhesions from old gall-bladder disease may involve the pylorus in such a way that the sphincter does not close properly and the duodenal contents are thus rendered unusually acid. This hyperacidity, in turn, causes or favors spasm of the common-duct sphincter with the increase in biliary pressure and resultant pancreatitis. Acute hæmorrhagic pancreatitis is by many considered always secondary to disease of the biliary tract, and in many cases it is associated with stones in the gall bladder.

It has been said that in women, the most common co-existing lesion with cholecystitis is appendicitis, while in men, duodenal ulcer is of more frequent occurrence. In these latter cases the diagnosis is very often confused, as the symptoms are frequently misleading, and those of the ulcer may easily overshadow those of the gall-bladder lesion. In gastric ulcer, likewise, there may be much confusion. The initial symptom of cholecystitis is a distress, not a pain, a feeling of discomfort in the epigastrium, dizziness, belching of gas and acid stomach-contents, sometimes nausea and vomiting. Those of ulcer may be very similar, but upon careful examination and inquiry the correct conditions can usually be ascertained. The common association of the two pathological conditions, however, is the thing to be remembered and searched for.

It is exceedingly well known that gall stones are more frequent in women than in men, and it is a matter of frequent occurrence for the gynecologist in operating for pelvic pathology to find a gall bladder full of stones, a condition which may or may not have been suspected previous to the operation. This speaks for the very wide prevalence of gall-bladder infection, particularly in women and especially in the third and fourth decades of life, those being the periods during which most of the pelvic pathology of women comes to operation. Pregnancy often immediately antedates an outbreak of gall-bladder disease in women, the relation here being that the mechanical factors of pregnancy tend to increase the already existing cholecystitis and bring about an acute attack.

Kidney involvement may be secondary to an old infection in the biliary tract. Infection here may travel hæmatogenously to either kidney or there may be direct extension through cellular tissue or lymphatics. Masses of adhesions about the gall bladder may bring about a mechanical displacement of the right kidney, with possible blocking or kinking of the ureter. A few cases are on record of gall stones having perforated the gall bladder and formed eventually, along with other pathology, an extensive infection about the kidney. Functionally, of course, the kidneys are affected in nearly all acute or even chronic infections of the gall bladder, albuminuria, low-grade nephritis or pyelitis occurring.

A very severe type of secondary anæmia frequently follows cholecystitis,—due perhaps to the infection acting as a hæmolytic agent on the red blood-cells, as distinguished from the anæmia of a hæmolytic icterus. This anæmia yields very quickly to removal of the gall bladder and consequent subsidence of the infection.

Lastly, the rôle of gall-bladder diseases as chronic foci of infection is a very extensive one, the importance of which has been recognized only recently. Cholecystitis is capable of setting up metastatic lesions in practically any part of the body and many cases of obscure arthritis, metabolic disturbances, low-grade septicæmias, abscesses, ocular disturbances, etc., are traceable to a diseased gall bladder, and many such cases have been entirely cured by removal of the original source of infection, the gall bladder.

With the marked prevalence of gall-bladder disease in adult life, especially in women, and with the very extensive amount of common pathology which can be traced directly to an offending gall bladder, the need for early recognition and eradication of the cause is increasingly apparent,—the need for early recognition, that secondary pathology may not develop and that the patient's time, health, and energies may not be wasted in useless treatment,—the early removal of the primary source of infection, that secondary disturbances and complications may not arise. Another important point to be noted in this connection is the necessity not only of looking for the gall bladder as a possible source of trouble in other conditions of the abdomen, but also the necessity of looking for associated pathology, once a diseased condition of the gall bladder has been found.

SUMMARY

To summarize, then, we find:

1. The existence of gall-bladder infection is more frequent than is commonly supposed.
2. The amount of pathology due to or associated with disease of the gall bladder is very extensive and is frequently overlooked.
3. The associated pathology of cholecystitis includes practically every abdominal organ and many structures in distant parts of the body.
4. The rôle of the gall bladder as a focus of infection is being more and more realized.
5. Not only should the gall bladder be examined in every pathological condition of the abdomen, whenever possible, but in every systemic condition of unknown origin or uncertain diagnosis.
6. In every case of diseased gall bladder, the surgeon should not be content with removal or other treatment of the primary condition, but should look for possible secondary pathology, that this, too, may be cared for.

In conclusion, it seems fitting to make a further plea for the operation of cholecystectomy over that of cholecystostomy. It seems that in an overwhelming proportion are the surgeons of today turning to the first of these procedures as the operation of choice, and it seems to me that this is rightly so. In review of the various arguments given for removal rather than drainage of the gall bladder, I may cite the following most important points:

1. The greater percentage of cases in which there has been no recurrence of symptoms. Statistics need not be quoted here, but as gathered from various reports in the literature this percentage has been large. The reasons for this are chiefly that fewer adhesions are formed when a clean removal of the gall bladder is performed than when there is long-continued drainage, especially when various gauze and other drains are used.

Biliary fistulæ occur much less frequently after cholecystectomy than after cholecystostomy.

Stones frequently, we might almost say usually, recur after drainage cases, whereas in total extirpation of the gall bladder, when the ducts are thoroughly explored and care is taken that no stone remains, the re-formation of calculi is very infrequent.

Cholecystitis, as such, does not recur following the operation of removal, whereas it is frequent after drainage.

Convalescence is briefer. There is no long and troublesome drainage necessary in the average clean case, and recovery is less stormy.

As regards the relative safety of the two operations, while the operation of cholecystostomy is undoubtedly attended by fewer immediate dangers in the hands of the occasional operator, cholecystectomy is still, in the hands of an experienced surgeon, a clean, safe, and adequate operation.

If, therefore, we consider the various operations from the standpoint of permanency of relief, cholecystectomy seems, in the majority of cases, to offer this in greater measure than any other operation upon the gall bladder. If this be true, the patient is entitled always to the treatment that is going to be not always the easiest at first, perhaps attended with slightly greater immediate risks, but the treatment that, in the end, is going to give him the most complete and most lasting relief, and this treatment I believe to be the operation of cholecystectomy.

AUTOGENOUS VERSUS HETEROGENOUS BONE PEGS[1]

BY GEORGE DE TARNOWSKY, M.D., F.A.C.S., Chicago

WHEN, on December 23, 1914, I used the first beef-bone peg in a transverse fracture of the femur, it was because of the growing belief in my mind that the ultimate fate of all bone grafts was complete absorption and replacement by new bone cells derived, not from the periosteum or osteogenetic layer of the graft, but from the living proximal and distal ends of the fractured bone. I must confess, however—and this same confession will be found in my first paper on the subject, published in SURGERY, GYNECOLOGY AND OBSTETRICS, in May, 1916—that I resorted to beef bone in my first case only after I had fractured a fibula intramedullary peg and had been refused the use of the patient's other fibula for a second attempt!

No claim to priority was advanced, either at the time of the first use of beef-bone peg in the Cook County Hospital at Chicago or in my first communication on the subject; neither was any effort made to trace the origin of the method. Dr. H. M. Richter first used a beef-bone peg on a patient in the Mt. Sinai Hospital, Chicago, on December 10, 1914, and a few weeks later repeated the same procedure at the Cook County Hospital. Although present at this second application of a beef-bone peg, no claim to priority was made to me by my then colleague on the County Surgical Staff. Both papers concerning the possibilities and limitations of heterogenous bone implants or pegs were presented solely for the purpose of stimulating the controversy which has been going on for so many years regarding the viability of so-called "living" bone transplants. Priority was never considered because, as in a majority of instances at least, careful search of the literature takes us back to the *Papyrus Ebers*, Galen, and the misty past!

In view of the poor success obtained in transplanting non-pedicled portions of muscle, fascia, and entire skin, not to mention the inevitable end-results of all glandular implantations, it did not seem reasonable to suppose that so-called living bone would prove to be an exception to the rule and remain viable when transplanted. Nathan (1) expresses himself most emphatically on this subject, stating: "Osteoblasts are restricted to the cambrium and marrow, and development of bone is confined to these regions. Bone grows in thickness by the deposition of new bone upon the periphery; it grows in length not by virtue of interstitial proliferation of the bone cells, but by proliferation of the cartilage cells at the epiphyseal line; in either case the osteoid tissue is deposited by osteoblasts which, once they have accomplished this, are no longer capable of proliferation. Even pieces of bone with periosteum and osteoclasts attached die when transplanted. Pieces of bone removed and reimplanted into the gaps from which they were taken do not grow in and resume their function. The bone corpuscles degenerate and the grafts are slowly but surely absorbed. What occurs is a more or less complete regeneration of the implanted bone as it is being absorbed. Bone dies when transplanted whether supplied with periosteum or not, and the success of the transplant depends upon the development of new bone." Marmourian (2) in the *British Medical Journal* of December, 1921, states: "All that the bone graft does is to supply the biochemical stimulus or irritant which had been abolished by trauma or infection; the new bone is formed by the diaphyseal ends, by periosteal and bony remains in the shaft zone and, in the young, by epiphyseal lengthening."

Gask, of London, who has had as much experience with war surgery and its reconstructive aftermath as any other British surgeon, speaking of the fate of bone transplants, says: "Those bone cells which are within reach of direct nourishment from the tissue in or on which they lie, may live; the main mass of the graft dies. By the end of the third week (after implanting a so-called

[1] Read before the Chicago Surgical Society, April 7, 1924. For discussion see p. 373.

living graft), new channels appear in the necrotic graft, penetrating from its periphery, carrying vascular loops and giant cells which continue to absorb the old bone. New bone cells also form on the surface of the graft. Eventually the whole of the graft is absorbed and replaced by new bone produced by the activities of the surviving cells. Bone grafts in contact with living bones are attacked by the cells of the living bones, invaded, and replaced. The only advantage of a living bone graft is that some of the peripheral bone cells, in contact with free blood, will continue to live and thus assist in the bridging over of the gap" (9).

E. W. Hey Groves of the University of Bristol, while believing that a living bone graft may act as a living tissue which under suitable conditions will build up new bone, admits that it also acts as a strut and a scaffold along and around which living bone spreads. This second function of a graft, he states, can be undertaken by dead bone as well as by living, and there are certain conditions in which dead bone is actually better than living bone for the purposes of a graft. He illustrated this point by exhibiting two tibias of a cat into the left of which he had fixed a living graft while a dead bone graft had been fixed in the right tibia, with identical results. That Groves has no faith in the osteogenetic power of the periosteum is manifest, for he states: "It has often been suggested that the periosteum surrounding the shafts of bone has an inherent power of forming new bone, and that, by taking flaps of this membrane, bridges may be formed which will cover in gaps and defects in the bone; but such an idea is founded upon false observations, and any attempt to fill up a gap formed by periosteal flaps will be doomed to failure, because such flaps after throwing out minute pieces of bone may then be absorbed long before continuity has been restored" (2). The purely mechanical value of the restoration of continuity is shown by Groves in the case of a child from whom the central portion of the humerus had been resected for fibrocystic disease. The operation involved the removal of 3 inches of the entire thickness of the shaft of the bone, while preserving the vascular periosteum. A two-piece graft made of boiled beef bone was implanted in the medullary cavity, and a roentgenogram taken 1 year later showed that the contour of the original bone had been restored. Somewhat sarcastically, he remarks: "It is a somewhat remarkable reflection on the mistaken idea which has sometimes been held regarding the dangerous nature of dead bone, to think that one can deliberately bury a large piece of bone which is not only dead, but which is not even human, in the skeletal tissues, that such tissue will be tolerated, then incorporated, and lastly slowly absorbed."

So far, there seems to be no logical reason for a change of opinion regarding the ultimate fate of all bone grafts, and my only excuse in bringing the subject up for discussion before the Society is to find out what proofs, if any, the advocates of the permanently "living bone graft" can adduce in support of their belief, and to produce evidence that not only ivory inlays, screws and nails as used by Magnuson, are well tolerated and slowly absorbed, but that the beef-bone peg or inlay is equally non-irritant in a majority of cases. My deductions are based on personal results obtained in 17 cases of beef-bone pegging and the use of ivory screws or nails in approximately 50 cases. Of the 17 cases there were for fractures of the femur, with one postoperative death from hypostatic pneumonia, 2 for unimpacted fractures of the neck of the femur with nonunion, 5 for fractures of the humerus after reduction had failed, and 2 for double fractures of the leg. Intramedullary pegs were used in all cases, my prime object being to evolve a simple technique which might be available to the average surgeon in the average hospital. The surgical instruments were for this purpose strictly limited to an ordinary hand saw, chisel, and mallet for the preparation of the beef-bone pegs, and Lane's bone-holding forceps and levers in addition to the ordinary bone set. In fractures of the femur, the peg should be 4 inches long in transverse fractures, 5 or even 6 inches long for oblique spiral or comminuted fractures; its diameter should be ½ inch. For fractures of the tibia or humerus, the peg should be 4 inches long and from ½ to ¾ inch in diameter. Any

the long bones of a steer will answer the purpose. The bone is denuded of its periosteum, cut to the proper size and boiled 2 consecutive days for 2 hours. The pegs are then kept in a sterile container and the peg needed for a given operation is resterilized with the instruments. It is of prime importance to fit the peg to the medullary canal and not to drill or gouge the canal in order that the peg may fit into it; under no circumstances should bone marrow be curetted away as we thus deprive living bone of its chief blood supply. The graft must be in perfect contact with healthy vascular bone above and below, it must be of sufficient length to reach well into living bone and it must be immobilized in this position. Occasionally, ivory or bone screws may have to be applied in order to insure against slipping of the peg. The introduction of the peg, after angulation of the seat of fracture after the technique of Lane, does not present any difficulties. In order to divide the peg evenly between the proximal and distal fragments, three-fourths of it may be introduced into the medullary cavity of one fragment and then, after alignment of the bone and introduction of the peg into the other fragment, one of two methods may be used to obtain the proper division of the graft and thus prevent the possibility of angulation. If a gap exists between the fragments, the peg is pushed up or down the required distance by means of a mallet and chisel; if no gap is present, an oblique hole is drilled over the long end of the peg into the medullary canal and the detached drill is used to punch the peg into place. Prior to alignment of the fragments, both ends must be thoroughly freshened with the bone curette or chisel, and after immobilization of the peg the soft tissues must be closely coapted over the repaired bone to insure its close contact with free blood before closure of the skin. No dead spaces must be allowed between bone and muscle or fascia.

During the slow process of absorption and replacement of a bone graft, there is relatively little strength to the graft and the limb must be protected from strong muscular action or weight bearing. Gask is of the opinion that protection must oftentimes be maintained for from 12 to 24 months. This period is not sufficiently emphasized and undoubtedly accounts for the failures reported with either autogenous or heterogenous grafts.

Of the seventeen pegs, only one was removed to my knowledge. This case was a compound comminuted fracture of the right tibia and fibula in which the bone fragments and muscles were ground full of pieces of gravel and slack. We introduced the beef bone too soon, acute osteomyelitis set in, and the patient drifted into the hands of another member of this society who removed the peg and finally obtained bony union. The other 16 cases and all of the ivory nails and screws were retained and well tolerated. All were observed from periods varying between 3½ and 6 months; all obtained firm bony union with roentgenographic evidence of slow absorption of the foreign body.

It is useless to remind the members of this society of the difficulty of keeping track of County Hospital cases, and only recently has it been possible to stumble on one case which was operated upon in July, 1915—almost 7 years ago—at which time a beef-bone intramedullary peg was introduced in the lower third of the right femur. This was case No. 570,178, Cook County Hospital.

Mrs. L. W., age 46, admitted June 18, 1915, with a comminuted fracture of the lower third of the right femur with outward and backward displacement of the fragments, the proximal fragment displaced outwardly for an inch, and a spicule of bone lying in the distal medullary cavity. Both proximal and distal fragments were fissured for a distance of 3 inches. The right lower extremity had been atrophied since the age of 9, at which time the patient had suffered from an acute anterior poliomyelitis. She had always been obliged to walk with the help of crutches or canes.

Between June 18 and July 8, 1915, repeated attempts at reduction had been made, without any success, and my colleague, Dr. Paul Morf, very courteously turned the case over to me for open repair. The operation, performed on July 9, consisted in the removal of many loose spicules of bone lying in the surrounding tissues and of one large one in the proximal medullary cavity. A 4-inch beef-bone peg was introduced; this was a mistake as a 5- or 6- inch peg would have extended beyond the fissured shaft and held firmly. The patient was put up in a body-thigh-leg cast. Owing to a change of services, the case was not followed as closely as was necessary and the new internes removed the cast

for what they termed a moderately severe infection. The splints and traction which replaced the cast failed to prevent some degree of angulation. By September, 1915, the infection had entirely cleared up, but there was only slight attempt at bony repair.

This case was classed in the original paper as an operative failure because both the proximal and distal fragments of the femur were fissured for a distance of 2 to 3 inches, satisfactory firm coaptation of the peg was impossible to obtain, and some degree of angulation occurred. In May, 1921, this same patient presented herself at the Ravenswood Hospital with a request that she be relieved of a fibrous ankylosis of the right knee which had persisted since she left the County Hospital. The plates exhibited were taken in May, 1921. They show extensive formation of new bone and there is present in the shaft of the bone what appears to be a sequestrum 10 centimeters long by 1½ centimeters wide. We purposely refrained from telling the hospital roentgenologist that a beef-bone peg had been introduced in this case in 1915, because we did not wish to bias his report. This peg represents a typical case of eburnation as its outline is still quite clear and it is evident that there is no attempt at absorption going on.

Of recent cases of beef-bone pegs reported, the following present more than ordinary interest as they illustrate the value of this method in bridging large defects.

Case 1. C. W. Gordon Bryan, *The Lancet*, May 28, 1921. A case of osteitis fibrosa treated by resection of 4 inches of humerus and the insertion of a boiled beef-bone graft. Bryan drilled his graft full of holes, believing that by this means the obsteoblasts would proliferate more rapidly and the osteoclasts become more active. The operation was performed in November, 1920, and the last roentgenogram taken on March 24, 1921, showed the drill holes filled with new-bone cells. The idea seems a good one and we intend adopting it in future. In this case the peg was driven distally into the medullary cavity and embedded proximally in the spongy tissue of the head of the humerus.

Case 2. P. Maynard Heath, *Proceedings Royal Society of Medicine, Section of Surgery*, January, 1922, reported the case of a 9-year-old boy suffering from fibrocystic disease of the humerus in whom he had removed the diseased bone and introduced a beef-bone graft in June, 1921, obtaining firm union with a large amount of new bone around the graft.

Case 3. Hey Groves, of Bristol, in addition to his many successful grafts on cats, reported several complete successes on human beings, using beef bone grafts. In fractures of the humerus he advocates the use of two beef bone grafts. One is thrust into the upper fragment, the other into the lower, each graft being allowed to project to a distance equal to that of the gap. The two projecting pegs are fitted and screwed together.

Fig. 1. Roentgenogram [illegible] after transplanting beef-bone splint.

CONCLUSIONS

The clinical behavior of a beef-bone graft depends entirely on the relative activities of the osteoblasts and osteoclasts:

1. With proliferation of new cells from the living proximal and distal ends of the fractured bone keeping pace with absorption of dead cells from the graft, complete disappearance of the latter coincides with complete union of the fracture or filling in of the defect.

2. With hyperactive new cell formation and sluggish absorption, the graft constitutes a sequestrum which either eburnates and remains in a state of quiescence or acts as an irritant foreign body with sinus forma-

tion and periodic extrusion of dead bone spicules.

3. With hyperactive bone absorption and sluggish new-bone formation the graft disappears by combined extrusion and absorption before union or filling in of the defect has taken place.

The factors which enable us to attain the ideal, i.e., an even balance of absorption and proliferation are: first, the thorough trimming off of dead bone proximally and distally with curette and chisel; second, firm approximation of the bone graft to living bone; and, third, absolute asepsis.

Finally it has seemed to us that the term infection, as applied to bone surgery, is too loosely used and that in many cases of so-called septic results we are merely dealing with type three, i.e., rapid necrosis of the graft without infection—using the latter term in its proper sense. In other words, subacute osteomyelitis, with no anti-body reaction on the part of the individual should not be classed as an infection but as ordinary tissue necrosis.

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DEPARTMENT OF TECHNIQUE

KINEPLASTIC AMPUTATION OF FOREARM -TRIMOTOR

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KINEPLASTIC amputations are of indisputable value. Because of scientific principles based on the neuromuscular physiology of the kinetic motor, because of improved and perfected operative technique, because of the results obtained in the function of the motor, and because of the improvements which have been made in kinematic protheses—for all these reasons, I say it is hardly believable that surgeons should regard with wilful disdain a problem of such grave importance.

Indeed, the benefits to be derived from the regular practice of such amputations are incalculable, and these benefits apply as well to humanity, to the state, and to the individual as to perfecting the technique of mutilative surgery, which, since the last terrible European war, has become a subject of intense interest.

To realize the desideratum of the surgeon, that is, to restore normal function to the amputated limb, giving to the protheses such movements as will enable the patient to perform at will the natural physiological functions of the mutilated member, constitutes, in fine, the trend of modern surgery. Kinematization, or kineplasty, as it has also been termed, is a procedure which no operative method hitherto known can put into practice. By means of kineplasty there is constructed on the segment of the amputated limb, a kinetic element termed "motor" which has the property of transmitting a living, voluntary, natural force to the respective prothesis and by means of this force the prothesis is endowed with active motion, governed by the patient's will.

When I began my studies, 4 years ago, I performed only simple operations, furnishing stumps with one motor (unimotor), as shown in Figure 1.

Later when I had acquired greater practical and theoretical knowledge, I ventured to perform operations which would produce two motors (bimotor), and obtained very encouraging results (Fig. 2). Finally, I have succeeded in giving to the patient whose case is presented in this present article, a stump with three motors (trimotor) by means of which an artificial hand may be worked. With three distinct, voluntary forces, independent of each other, the hand is capable of performing varied and even complementary movements resembling those of a normal hand.

The technique which I have followed in the construction of motors is that described by Pellegrini [illegible]. The patient I operated was a poor man, who had lost both of his upper limbs. On the stump of the lower third of the right forearm, I succeeded in getting three motors which would reproduce the natural movements necessary to move the hand prothesis.

The first motor was constructed by suturing, in handle form, the superficial flexor muscles with the deep-lying flexors (Fig. 3, *1*). In order to bend the fingers of the artificial hand, the patient contracts the same muscles which he used for closing the hand lost by mutilation, and the new adaptation of the motor to the prothesis, will, therefore, be made easy because of its similar function.

It is worthy of note that the [illegible] the disabled is facilitated by using in the construction of the motors, muscles which must continue to work in the fashion intended by nature, as was done in the case illustrated.

The second motor was constructed on the under surface of the forearm with the common extensor muscles of the fingers. The same technique was followed, the extensors being sutured with the rear cubital in handle form. With this second motor the fingers of the prothetic hand could be extended. In this instance I made the epidermic tunnel of the motor "eye" larger, as it is good and sound technique to build "eyes" of large diameter. With such an ample organic coupling there is a larger area of adaptation for the appliance of prosthetic or inorganic insertion, hence, the motor power is transmitted to the prothesis without any of the drawbacks of ulceration of the skin of the tunnels, as occurred with my first patients (3).

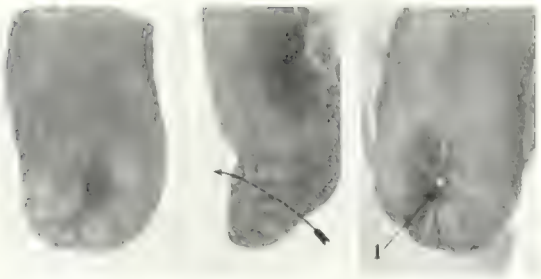

Fig. 1. Motor with a single handle "eye." Operative results after 10 days. *1*, "Eye" with epidermis healed. The arrow indicates the direction of the "eye."

Fig. 2. Double motor for leg (bimotor).

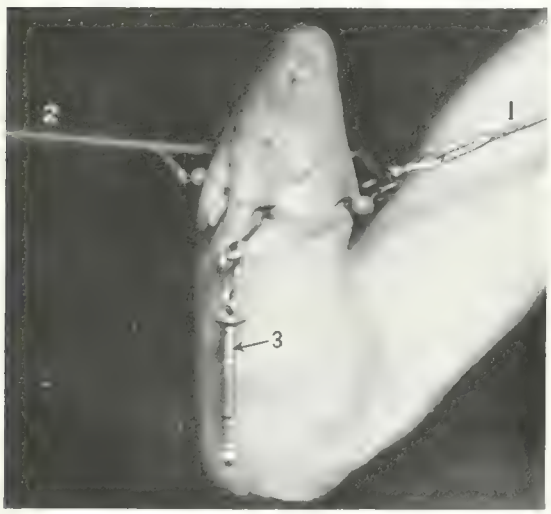

Fig. 3. Trimotor of forearm. *1*, Flexor motor, *2*, extensor motor, *3*, motor for thumb.

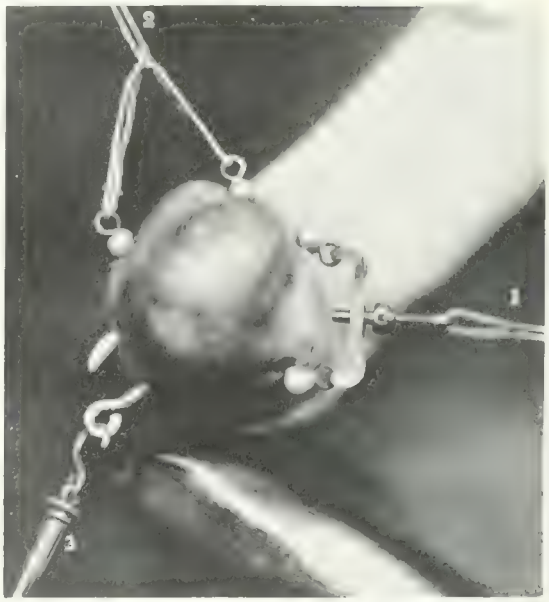

Fig. 4. Stump of forearm with three motors seen from front in order to gauge distribution of periphery. *1*, Flexor motor with tractor appliance; *2*, extensor motor; *3*, motor proper to thumb.

The larger the motor "eye" the surer will be its practical results. This has been proven not only clinically but also as to a principle of mechanics; i. e., the greater the friction, the more wear and tear, and conversely the less friction, the less attrition. A small motor "eye" produces in the patient greater wear and tear, for it causes greater friction and the skin suffers, becoming abrased, eczematised, and ulcerated. On the other hand, a large "eye" of ample diameter, 1 centimeter, furnishes a greater area of adaptation with less attrition and less friction to the skin, and ulceration of the epidermis is less likely to take place.

The third motor I made on the outer surface of the forearm (Fig. 3, *3*). A similar technique was used and the extensor muscles of the thumb were sutured. Cicatrization was excellent and there were no complications worth mentioning.

Voluntary exercise of the three motors was begun. At first, the function, as well as the motor power, was at a minimum, but with time and the perseverance of the patient, greater mobility and potency were attained. For exercising, the patient used an appliance with an ordinary hook from which hung a small bag of sand. The forearm was held close to the body in a hanging position while the exercises were done. Every fortnight the weight of the sand bag was increased by filling up with more sand, and the

Fig. 5. Kinematic hand for a bimotor of forearm constructed by Fusaroli, Rizzoli Institute, Bologna.

Fig. 6. Fusaroli kinematic hand. Photograph shows the patient working the motor of the thumb. The fingers closed. With these finger movements, the patient is able to feed himself, smoke, write, etc.

usual exercises were carried out. The three motors were trained in like manner, but the first one was the most easily trained, perhaps, because the patient himself devoted more attention to it.

Nevertheless, we felt satisfied with the result and believe that, when the patient is provided with a complete prothesis and finds it necessary to use the corresponding motors, there will be improvement in both scope and power.

A year after operation the patient's forearm was found in highly satisfactory condition. The stump with its three kinetic "eyes" is shown in Figure 3. The three motors are side-motors of the type invented by Pellegrini, and their perfect condition may be observed in the figure. Motor *1* is the flexor; *2* is the extensor, and *3* is that of the thumb. Viewed from the front (Fig. 4), the stump is gauged in its peripheral distribution. As the operative technique plan had now been completed it remained for me to complete the result by means of a prothesis.

Under Professor Putti's direction, the mechanical problem has been studied with singular success, and the orthopedist Fusaroli has constructed a hand for a bimotor of forearm. This is the one I placed on my patient (Fig. 5).

The hand is made so that it will produce movements of the metacarpophalangeal joints, making them work in harmony. There are really no interphalangeal joints, that is, the fingers are stiff but are made as if half bent, resembling the position of the fingers in repose. The movement of the fingers is effected by means of this appliance, and they flex or extend by means of the two tractors corresponding to the flexor or extensor motor as the case may be. The thumb is moved by the aid of the metacarpophalangeal joint, and is passive, that is it is not constructed so as to be moved by a motor. In my patient, the third motor, constructed precisely from the extensor muscles of the thumb, is used to work the thumb, passive extension being accomplished by means of a spring.

To sum up, Fusaroli's hand is fitted for adjustment to a bimotor of the forearm, using one tractor for flexion and the other for extension. The thumb is immovable. As my patient has three motors and one of these is worked by the extensor muscles of the thumb, it is logical that I should wish to make use of this unique and important finger. I am working along these lines and hope to re-educate the mutilated limb. This is of primary importance, inasmuch as the mechanism for working the thumb is very simple. The metacarpophalangeal joint is a movable one. Extension is produced by means of a spring, and flexion is brought about by the third motor which, at present, has proven so satisfactory as to encourage hopes of greater result.

My patient, who had lost both upper arms, was in a desperate condition. It was painful to hear him tell of the trials and misfortunes of his private life, for he was the father of a family for whom he must provide through his own efforts, and his task became an almost insurmountable problem. More than once, I thought that my

Fig. 7. Film showing finger movements.

promise to give him a hand might not prove true and the man would be deprived of the only illusion left to him. He became so desperate that he had planned suicide, but thanks to my promising unconditionally, absolute success, I was able to keep the poor fellow from carrying out his threat. He relied absolutely on me, and I was glad to be able to secure three motors, which I trust will give as excellent results as I obtained with the flexor motor.

The prothesis was modified and mounted by the orthopedist, Scheurer, who has always seconded me in this humanitarian and scientific work, and to whom I owe in part the admirable success obtained. I acknowledge most gratefully his labors.

After 3 months' practice, the patient is able to eat easily without any assistance, holds a glass to drink from, smokes, takes off his hat, handles many things required in daily life, writes, etc. (Fig. 6). To present real and tangible proof—a living document—of the result in my case, I have taken films, showing the patient doing ordinary things (Figs. 7 and 8).

The fact is worth stressing that the poor cripple is like another person, as is often said, for he enjoys living to a degree as encouraging as his previous depression was alarming. The joy he has in feeding himself, drinking water freely, smoking, etc., is spontaneous and effusive, for he feels that he is now a useful member of society and can enjoy his home with his dear ones. He wants to secure employment in the factory where he was injured. He has a stimulus for work.

I should be sorry to be termed a visionary for expressing myself in such enthusiastic terms, but I have seen and felt the unlucky fate of the poor cripple, and have witnessed the sudden change effected in him upon acquiring a hand, through which he is able to perform, at his own good will and pleasure, acts, which though elemental, are none the less interesting. Above all it is gratifying that we have succeeded in dispelling his intense depression.

Fig. 8. Film showing lighting cigar and smoking.

Naturally, in order not to become too enthusiastic in judging the results secured in this case, I must consider that besides the psychological effect upon the patient, we have at the same time succeeded in interesting him in perfecting the apparatus, and he is convinced that his future is dependent on his own will. All his cheerful enthusiasm converges toward a definite end which he glimpses inwardly and clearly: *to utilize*

It is as well to state that in the present development of kineplastic surgery, we can hardly accept such optimism, and if I encourage my patient to a certain extent to believe this, that does not mean that I hold the same enthusiasm, for it must be said in justice to the subject that in reality one is confronted with insoluble biological problems.

The grafting or transplanting of entire limbs, therefore, suggests itself to us as the desideratum of plastic surgery, but here, again, we must not let our enthusiasm unduly influence our better judgment. Let us then pass over the theoretical considerations, and say in conclusion, that our real object in doing kineplastic amputations is to help solve the problem of the welfare of these unfortunate cripples.

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PRESERVATION OF THE MOTOR ROOT OF THE GASSERIAN GANGLION DURING THE DIVISION OF THE SENSORY ROOT FOR TRIFACIAL NEURALGIA

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IT is possible to preserve the motor root of the gasserian ganglion by anatomical dissection without the aid of faradization during the division of the sensory root for trifacial neuralgia, and I wish to present the technique employed since March, 1922, in nine consecutive cases, in which satisfactory results were obtained.

ADVANTAGES AND DISADVANTAGES OF THE RADICAL OPERATION

It is quite generally accepted that the radical treatment of trifacial neuralgia is the division of the sensory root of the gasserian ganglion except in cases in which the diagnosis is doubtful or the duration of symptoms short, and then deep alcohol injection should be employed once, twice, or possibly three times, or in cases in which the division is too great a surgical risk. Inasmuch as the radical operation is attended with fewer and fewer complications, the patient should be advised to undergo operation rather than be carried along indefinitely on alcohol injections. There are special indications for the avulsion of peripheral nerves, but as a rule, better palliative results follow alcohol injections, except perhaps in the distribution of the ophthalmic division, particularly the supra-orbital and supratrochlear nerves, which are difficult to inject; moreover the procedure is sometimes attended with serious complications in the orbit. Some of the primary objections to the division of the posterior root are as follows:

1. Hæmorrhage. This now rarely gives trouble, owing to the changes in technique, the ability to control hæmorrhage by ligation of the middle meningeal artery and packing with cotton pledgets, and to the use of special instruments, such as the illuminating retractor, the dissecting hook, and so forth.

2. Ocular palsy, due to hæmorrhage and trauma to the third, fourth, and sixth cranial nerves. This has been obviated by traction on the dura in the exposure rather than application of pressure against the tissues in the vicinity of these nerves.

3. The high mortality rate. This was due to hæmorrhage and trauma to the brain, and has been lowered by the reduction of the time for the operation. At one time, from 2 to 3 hours were necessary to complete the operation; now, it can be performed in 1 hour or less, including time from the giving of the anæsthetic until the wound is closed and the patient is ready to be sent to his room.

4. Traumatic keratitis or trophic keratitis. This has been diminished by the avoidance of unnecessary trauma to the ophthalmic portion of the gasserian ganglion, and by protection of the cornea from abrasion during and immediately following operation. The patient should be acquainted with the anæsthesia of the cornea and cautioned against the entrance of foreign bodies into the eye which would scoriate the cornea.

5. Occasional facial paralysis. This complication develops occasionally regardless of the technique employed or the care exercised by the surgeon. We have all had the experience of performing a long series of operations without facial

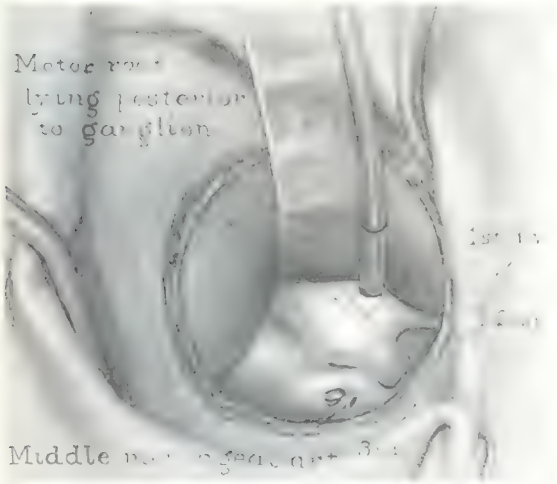

Fig. 1. Exposure of the gasserian ganglion with its arachnoid covering previous to division of the posterior sensory root.

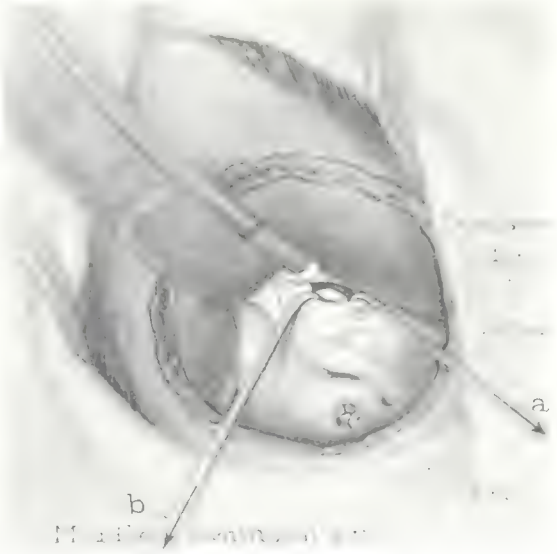

Fig. 2. Exposure of the motor root by the removal of the sensory root fibers of the posterior portion, covering and lying on the motor root. Division and retraction of the sensory root fibers from the gasserian ganglion.

paralysis, and then the condition develops without any known reason. Many theories have been presented with regard to its probable cause. It is consoling to know that the facial paralysis is usually only temporary, and recovery is spontaneous, but the cornea must be protected during recovery.

6. Numbness of the face, eye, and margin of the tongue along with paralysis of the pterygoid, masseter, and temporal muscles. It is true that the numbness is quite annoying, especially at first, but it is much the same, although less extensive, than that which follows successful alcoholic injection or peripheral nerve avulsion. However, the patient who has had one or two recurrences of true trifacial neuralgia gladly accepts the numbness in exchange for the spasmodic, excruciating, lightning pains incident to the disease.

7. Paralysis of the pterygoid, masseter, and temporal muscles disturbs the alignment of the jaw on opening, prevents good coaptation of the teeth on the side operated on, and causes atrophy of the muscles and depressions above and below the zygoma. While it is possible to preserve the motor root and thereby prevent motor paralysis, there is no particular object in saving the motor root in a very old patient who has had all of his teeth removed on the affected side and who does not intend to use a plate. Nor is it wise to save the motor root if the question of time is an urgent factor in the operation on an elderly patient. However, the preservation of the motor branch is an added refinement in the technique and avoids paralysis of the two pterygoid, masseter, and temporal muscles. It should also be preserved, since there are a few double neuralgias and because patients are coming for the radical operation earlier in the history of the disease when still possessing a few teeth on the side affected by the neuralgia.

While it was necessary to rely on faradization of the motor root in order to determine absolutely whether or not it was preserved, the technique was very tedious, prolonged, and uncertain on account of the electric current jumping from sensory fibers to motor fibers, and giving rise to false interpretations. With the development of this technique, I find it possible to dissect the sensory root from the motor root and divide it without injury to the motor root in approximately the same time that is required to expose and divide the entire posterior root of the gasserian ganglion.

The motor root, as it enters the middle fossa over the petrous portion of the temporal bone through the hiatus in the dura, is found underneath the sensory root on the mesial side; it continues in that relation under the root fibers until it approaches the gasserian ganglion body, when it turns fairly abruptly and passes obliquely downward and outward underneath the gasserian ganglion through a separate sheath of the third branch into which it diffuses.

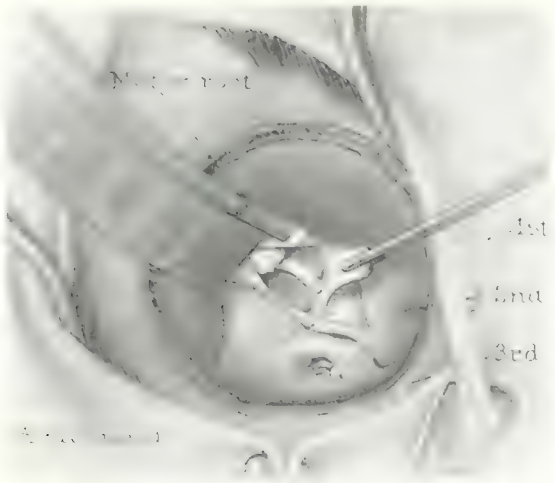

Fig. 3. Elevation of the divided posterior sensory root fibers exposing the motor root as an independent fasciculus entering a separate sheath beneath the ganglion body before submerging into the third branch of the gasserian ganglion.

Fig. 4. Case A386731. Normal symmetry of the face due to preservation of the motor root in the division of the sensory root of the gasserian ganglion.

TECHNIQUE OF OPERATION

The ganglion is exposed through an oblique incision of the skin, temporal fascia, and temporal muscle, situated 1 centimeter in front of the ear and extending upward and backward from the zygoma for 7 centimeters. This is followed by a decompression opening in the skull which is about 3 centimeters in diameter, after which the dura is elevated, the middle meningeal is ligated, the third branch identified, and dissection carried upward and backward elevating the dura from the arachnoid which is attached to the ganglion, until pulsation can be seen above the ganglion. These pulsations occur over the posterior root and are due to changes in cerebrospinal fluid by the pulse of the cerebral vessels (Fig. 1). The arachnoid covering the posterior root fibers is then opened by a small, sharp, right angled knife, exposing all sensory root fibers and the outer part of the gasserian ganglion (Fig. 2).

After bleeding is controlled my associate holds the illuminated retractor which gently elevates the temporal lobe, holds the dura taut, and exposes the posterior margin of the gasserian ganglion along with the sensory root. The small dissecting hook *a*, in Figure 2, is then placed over the sensory root fibers on the mesial side just as they enter the ganglion; these are retracted gently in a downward and forward direction, elevating slightly the posterior sensory root fibers and the posterior margin of the gasserian ganglion on the mesial side. Hook *b*, in Figure 2, catches the mesial side of the sensory root, but not underneath, and elevates by traction downward and outward sufficiently to expose the motor root lying as a separate fasciculus underneath and independent of the sensory root presenting a downward course toward the third branch rather than following the sensory root fibers upward and inward to the mesial side of the gasserian ganglion.

After the motor root is brought into view, the sensory root is held away from the motor root by hook *a*, and dissecting hook *b* is replaced by a small sharp right-angled knife, cutting the sensory root fibers without injury to the motor root (Fig. 2.)

After this, it is well to elevate the posterior margin of the ganglion (Fig. 3) to make sure that no sensory fibers remain intact. There is no danger of mistaking the motor root fibers for the sensory fibers, inasmuch as they enter a separate sheath beneath the gasserian ganglion body before diffusing in the third branch of the gasserian ganglion. Precautionary care should be exercised carefully to examine the hiatus in the dura over the petrous bone, and to avoid leaving sensory

fibers either on the mesial side or on the lateral side of the posterior root.

I have used this technique in nine consecutive cases since March 16, 1922, and have had no difficulty in preserving the motor root, being able to divide the sensory root just as quickly and as accurately as when dividing the entire posterior root, sensory and motor. After division of the posterior sensory root, one must be cautious to avoid unnecessary sponging of the motor root, as the slightest trauma will impair the function of the pterygoid, masseter, and temporal muscles; the impairment is, of course, only temporary, but if a perfect result is expected, trauma to or traction on the motor root must be avoided. Fig. 1

I do not claim to be presenting a new theory concerning the advantages of the preservation of the motor root, nor do I wish to detract from the value of any technique employed for the preservation of the motor root during the division of the sensory root for trifacial neuralgia. The technique is submitted because it can be quickly and easily carried out without the uncertainty that comes with faradic stim-

A CASE OF PRIMARY CARCINOMA OF THE FEMALE URETHRA TREATED WITH RADIUM

BY LAWRENCE A. POMEROY, M.D., F.A.C.S., AND FRANK W. MILWARD, M.D.,
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THAT primary carcinoma of the female urethra is a rare disease is shown by the fact that the subject has received but scant attention in standard textbooks on gynecology. Likewise, but few authenticated cases can be found in the literature.

Kelly and Burnam (1) describe primary urethral carcinoma as a rare disease in which the cancer begins in the mucous membrane at the external margin of the urethral canal or at some point between the external and internal meatus. They state that it may arise also from Littré's or Skene's glands, and that it may be either squamous-celled carcinoma or cylinder-celled (glandular form). The first form, they say, "spreads throughout the length of the urethra and extends into the bladder, or pushes out into the neighboring tissue in cancerous nodes. It may appear at the external urethral orifice, ragged, deeply cleft, and bleeding. Its lymphatic extension is up the inside of the pubic ramus and into the inguinal glands. The superficial, external form develops a hard, infiltrated, flattened area of ulceration spreading out over the surrounding mucosa, involving the vestibule and clitoris, as well as up under the mucosa of the urethra." This is as good a description of the subject as we have been able to find. Kelly and Burnam suggest two points which seem to be borne out in our case, namely (1) that the disease develops in a urethral orifice which has been infected by a low grade chronic inflammation often found in women (caruncle probably preceded the disease in our case), and (2) that, surprising as it may seem, these patients usually retain urethral control. In our apparently well advanced case the patient retains control of the urethra.

O'Neil (2) brings the subject up to date and emphasizes the fact that the disease is frequently incorrectly diagnosed. He reports his own case and eight others from the records of the Massachusetts General Hospital, and quotes cases reported by various authors, including the very complete and critical summary by Percy (3). O'Neil's report includes 68 cases of primary carcinoma of the female urethra which have been reported to date. We wish to report an additional case which we feel to be worthy of note in that it calls attention to the fact that carcinoma, uncommon as it may be in the female urethra, seemed in our case to have followed a caruncle, which we all know to be characterized by its frequency.

December [illegible] Mrs. [illegible] Hospital, referred from another institution. She complained of bleeding from the vagina accompanied by sharp pain which became worse when she voided. The patient was [illegible] but appeared to be [illegible] old enough to wash dishes when the Civil War was in progress. The patient was [illegible] and [illegible] She was [illegible] to have come from the [illegible] [illegible]

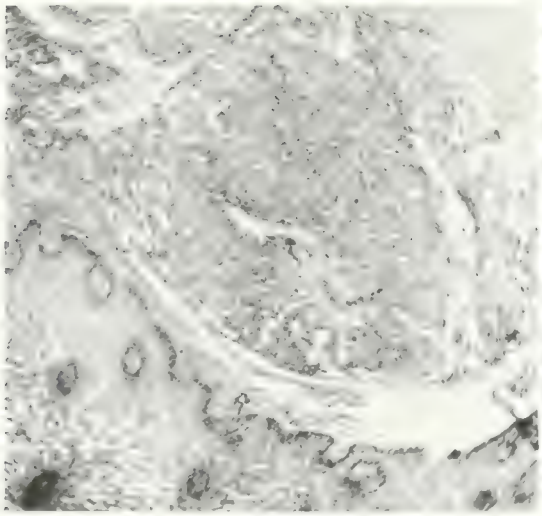

Fig. 1. Low power photomicrograph of tumor.

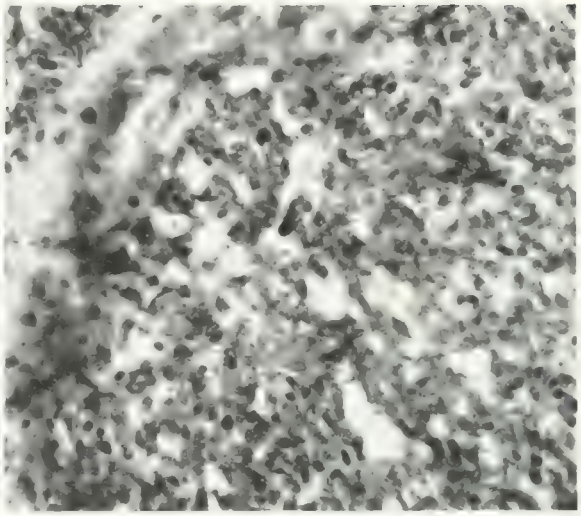

Fig. 2. High power photomicrograph of tumor.

had had these attacks of pain and bleeding "off and on" at intervals of 2 or 3 days and lasting a few hours each time. She had had some frequency of urination, usually rising at night two or three times to void. She thought she had lost some weight, but not more than a few pounds in 5 years.

The physical examination revealed that the patient was extremely well developed and well nourished for a woman of her years and displayed unusual physical activity and clearness of mind. The head was negative. The eyes reacted well to light and accommodation with only moderate arcus senilus. The teeth were in very poor condition, many being missing, and there was considerable oral sepsis. The neck and chest were practically negative although there was some evidence that the patient had had at one time a tuberculous process in the right apex, but without signs of recent activity. The abdomen revealed no masses and the liver and spleen were normal in size. There was no glandular enlargement apparent in the inguinal region or elsewhere in the body. There was moderate tenderness elicited just over the bladder, which was not distended during the examination. The extremities were negative and the reflexes were present without abnormality. Rectal examination revealed nothing of importance except a few hard, external hæmorrhoids.

Vaginal examination revealed what was first thought to be a large, ulcerated, cervical cancer which filled the entire introitus. Further examination revealed that this foul, ulcerating mass was firm, globular, measured about 4 by 4 by 3 centimeters, filled the external urinary meatus and extended upward along the posterior wall of the urethra about 3 centimeters. The vagina was absolutely free. The remainder of the examination revealed a senile uterus with normal cervix in good position.

Further questioning brought out that the patient thought she had had a small "warty" mass on the urinary meatus for several years. No evidence of cancer could be found elsewhere in the body, there being no enlargement of

On successive examinations the urine was cloudy, with a specific gravity varying from 1014 to 1016. There was a marked trace of albumin but no sugar. Microscopic examination showed numerous leucocytes and red blood cells.

The blood examination showed:

Red cells	4,900,000
Leucocytes	5,442
Hæmoglobin	95 per cent

Differential count:

	per cent
Polymorphonuclears	64
Mononuclears, large	6
Mononuclears, small	29
Eosinophiles	1

Wassermann reaction was negative.

A tentative diagnosis or primary carcinoma of the urethra was made.

Under ether anæsthesia a more complete examination was made, which revealed nothing more. A small portion of the tissue was removed for laboratory pathological diagnosis and radium was applied. Five steel needles each containing 10 milligrams of radium element were inserted directly into the tumor at about equal intervals from each other and allowed to remain in position for 12 hours. In addition one tube containing 50 milligrams of radium element screened with 0.5 millimeters silver, 1 millimeter brass and 1 millimeter hard rubber was inserted into the urethral canal and allowed to remain for four hours. This made the total radium treatment 800 milligram hours.

The patient had only the usual postoperative and radium nausea and 2 days following the treatment was up and about without any unusual symptoms. Twelve days after the treatment the patient had suffered no tenesmus or other symptoms, and examination revealed that the mass was one-third less in size, was much cleaner and accompanied by considerably less discharge.

Pathological report No. 3032. A very small piece of rather friable tissue from the urethra. Microscopic sections show a surface covering of squamous epithelium. Directly beneath this are large masses of cells, some of which appear to be of the squamous-cell variety while others have a distinctly columnar or glandular type

The whole is accompanied by [illegible] cell infiltration. In some areas the picture is that of epithelioma but without any epithelial pearls. On the whole the picture more strongly resembles a papillary carcinoma. The gland has begun to undergo carcinomatous proliferation.

The treatment of this important condition varies considerably, but, in general, thorough extirpation of the anterior portion of the urethra seems to be advised for the early cases. This can be done without sacrifice of the vesical sphincter. In some cases as cited by Kelly and Burnam [1] even the bladder may be sacrificed when necessary. There is a difference of opinion as to the necessity of the dissection of the inguinal glands. Kelly and Burnam advise this, while Crossen (4) points out that drainage by the lymphatics is to intrapelvic glands, hence inguinal dissection is unnecessary unless the operation is done for a wide-spread case. Crossen has devised an ingenious plastic resection of the urethra after primary drainage of the bladder through the vaginal wall.

X ray has been reported as of value in the palliative and postoperative treatment of the disease.

It seems to us that radium, because of its accurate and easy application, offers a better chance for the well advanced case than operative interference.

Kelly and Burnam advise the use of radium following the operation as a guard against recurrence.

Our case being in a very elderly person and appearing to be extensive, although no definite evidence of lymphatic involvement could be made out, we thought to be best treated by radium, as this could be done without submitting the patient to the shock of a more or less extensive operation.

Fig. 1. [illegible] introitus.

SUMMARY

1. Primary carcinoma of the female urethra is a rare disease, our case bringing the total reported in the literature to 69.

2. Urethral caruncle, although a relatively common affection of woman, may be followed by malignant degeneration, hence the importance of its early recognition and treatment.

3. Cancer in this location, although rare, should be recognized early and rigorous treatment instituted.

4. Treatment in the early cases consists of radical extirpation even to the extent of resection of the bladder, but this should be rarely necessary. In most cases the vesical sphincter can be saved in the operative procedure.

5. Radium should follow all operations and may be used alone in the well advanced cases.

Note: Since the [illegible] the following article has come to the notice of the authors, Le cancer de l'urètere chez la femme. Vernot and Parcelier. Rev. de chir., 1921, [illegible] case that they accepted and telling why some others were rejected. This is an excellent article, and should be read [illegible]

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THE THIERSCH GRAFT IN THE RADICAL CURE OF FRONTAL SINUS AND MAXILLARY ANTRUM DISEASES

Its Further Application to the Tonsil and Gingival Sulci[1]

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I AM pleased to present to you tonight three cases, one of frontal sinus suppuration, another of suppuration of the maxillary antrum with marked polypoid degeneration, and the third, repair of lower lip by a Thiersch graft and double tube pedicle. The frontal sinus operation was performed according to the method of Lothrop, and the technique of Denker was carried out in the case of the antrum, for the eradication of disease in these cavities, supplemented by the application of a Thiersch graft in one, two, or three pieces to the carefully dried surfaces of the entire cavity.

In the radical cure of frontal sinus or antral diseases it seems only reasonable to me, that the sinus surfaces which have been rendered bare, should be covered, preferably with a skin graft of the Thiersch variety, thereby *insuring* one of eradicating the disease, and leave a cavity which shall be free from future trouble. Dripping, weeks of irrigation, and the formation of scar tissue is avoided. I applied this principle to a gentleman over one year ago. He had had three external antrum operations covering a period of 5 years and had never been free from dripping. Since the procedure he has been entirely free from this distressing condition and the airway is free. Skin grafting of the frontal sinus and maxillary antrum has passed beyond the experimental stage as shown by the reports of Smith, Gillies, and myself. Its application to the tonsillar sulcus is still experimental. Probably before long, better methods will be evolved which will simplify the transplanting of skin to this cavity.

TECHNIQUE

The graft is cut, preferably from the right inner aspect of the thigh, to include the papillary layer of the corium and, if properly cut, only a slight amount of punctate bleeding ensues. It is placed upon a metal plate with its raw surface uppermost and evenly spread out. It is then covered with gauze wet in physiologic salt

Fig. 1. Lip sulcus rendered free from offending scar tissue by excision, with exposed bone of mandible.

Fig. 2. Skin covered mold placed in lip sulcus.

[1] Delivered before the New York Academy of Medicine, December 17, 1921.

solution, until required to use in the area to be grafted. Four large pieces are taken to insure against a disaster. The sinus cavity is thoroughly freed of its diseased membrane, rendered dry by pressure sponging and the use of adrenalin chloride. The graft is inserted in the sinus cavity and placed over the intact anterior sinus wall. It is made adherent to the bone by the use of the Ballance catheter and then further spread over the vault of the sinus, brain plate, and exposed bone area of the newly made common nasofrontal duct. It is held in position by pledgets of cotton, by following the method used by Dench in skin grafting radical mastoid cavities. The method consists in using one or more small pledgets of cotton tied to long pieces of twisted silk and packed tightly in the cavity, the strands of silk thread being brought out through the nares. The pledgets are allowed to remain 5 or 6 days. The cavity is not irrigated as a rule until after the tenth day. If there is marked desquamation of the grafted surface and (sometimes there may be) especially at the junction of the overlapping grafts, due to epithelial overproduction, this scaling can be controlled by the application of sterile liquid alboline.

In the case of the antrum the same procedure is followed, except in using pledgets of cotton, one can use a small soft ballon with catheter attachment. This is inserted through the nose

[illegible] in the deflated state [illegible] position in the antrum, it is inflated to such a degree of [illegible] sure. After the sixth day it is deflated and removed. When using cotton pledgets with attached strands of silk I prefer to exit them through the gingival incision.

By allowing the external wound to remain open, one is able to determine, after removing the pledgets of cotton, how well the graft has

Fig. 4. Start [illegible] ulous.

Fig. 5. Pil[illegible]

Fig. 6. Eradication of disease of frontal sinus after the method of Lothrop. Thiersch graft in position held in place by pledgets of cotton.

taken. In no case should the cavity be irrigated until after the tenth day.

In the third case the inside of the lip was grafted after the free excision of offending tissue. Epithelization of this new sulcus was obtained by the use of a skin graft wrapped around a suitable mold and sewed in.

The great advantage of grafting the tonsil sulcus after tonsillectomy is obvious, as it prevents cicatricial contraction and diminishes postoperative hæmorrhage. After the tonsil is removed, bleeding is controlled by one of several methods. Skin grafting of this new sulcus is obtained by making a mold of the cavity, the graft being applied to its surfaces, raw area outermost. The pillars of the fauces are sewn together by two or three mattress sutures over the skin-covered mold. The mold and sutures are removed after the fifth day. The throat is kept clean with gargles of saline.

Case 1. Frontal sinus disease, after operation. Application of a Thiersch graft to its bony surfaces. Mr. C. H., age 28, referred by Dr. A. C. Patient had suffered with pan-sinusitis for 15 years. Several intranasal operations had previously been performed by other surgeons.

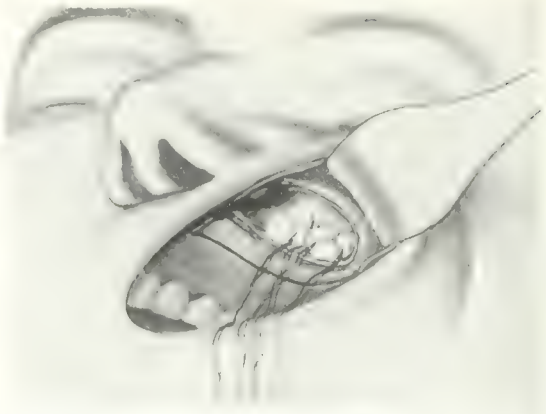


Fig. 7. Eradication of disease of antrum after the method of Denker. Thiersch graft covering bony surfaces with pledgets of cotton to keep the graft in place.

On September 28, under local anæsthesia, a secondary septum operation was done and both middle turbinates removed. The ethmoidal labyrinths and sphenoids were exenterated, the antra opened and drained.

On October 25, as the cervical glands were markedly enlarged and the tonsils diseased, they were removed, under local anæsthesia.

On November 10, polyps removed from left ethmoidal wall, under local anæsthesia.

On November 19, under general anæsthesia, a radical frontal sinus operation was performed according to the method of Lothrop. This was supplemented by the application of a skin graft of the Thiersch variety.

Condition at present, December 21, 1921: Headaches have passed: swelling of the cervical glands has subsided; mucous membrane lining bony surface replaced by skin as demonstrated by the use of nasopharyngoscope. The ethmoidal labyrinth is still weeping. The antra after daily irrigation are clear. Gained 6 pounds in weight.

Case 2. Morris D., age 29, suffered with left maxillary antrum suppuration with nauseating odor from nose. He had lost weight and appetite and was always tired.

On December 8, under local anæsthesia, operation was done. The cavity was full of polyps and very nauseating pus. Bleeding was controlled by pressure sponging and adrenalin chloride. Necrosis of the roof of the antrum. Method of Denker followed, supplemented by skin graft of the Thiersch variety.

Condition December 21, 1921: Marked reduction of nasal discharge. Mucous membrane lining antrum surface replaced by skin, as demonstrated by the use of the nasopharyngoscope.

Case 3. Mary D., age 21, referred by Dr. J. J. H., suffered a destruction of lower lip, chin, and loss of gingival sulcus. She had an ugly scarring of the right inner canthal region and the left side of face.

On October 8, 1919, a tube pedicle was made from right chest region. The offending scar tissue was removed and a new lip sulcus made. This whole cavity was lined with skin of a Thiersch variety. Two subsequent operations failed to repair chin and lip.

October 14, 1921. Left side of neck tubed.

November 14, 1921. Left tube to chin and lip, with stump of right tube to repair right angle of mouth.

Condition, December 21, 1921: Mouth lined with skin. Skin and lip repaired by still intact double tube pedicle.

EDITORIALS

SURGERY, GYNECOLOGY AND OBSTETRICS

FRANKLIN H. MARTIN, M.D. .....
ALLEN B. KANAVEL, M.D. .....Associate Editor

SEPTEMBER, 1922

"THE PARTY OF THE THIRD PART"

TRANSITION from the old to the modern scheme of medical education is a conspicuous achievement of two decades. During this brief period scientific medicine and medical schools have become a new thing in the world's pedagogic endeavor.

It is of interest to note that during these twenty years one-half of existing medical schools have been eliminated with a corresponding decrease of the student body. Expansion of plant equipment, general and departmental, has called for tremendous outlay on the part of institutions. Elaboration of curricula with its exaction for higher standards has created a demand for larger and better equipped teaching forces. Finally there must be noted the added years for undergraduate study and the increased per capita cost, which is conservatively estimated at from fifteen hundred to two thousand dollars a year per student. These factors are basic in our present régime and it is quite strange that much concern is aroused on the part of administrators whose task it is to "carry on" and to make provision for future expansion.

Very recently in [illegible] high in authority a word of caution to the effect that in this modern scheme teachers seem to be losing their sense of proportion in an effort to do the impossible, the inference being that in the expansion of courses time is wasted upon what Hamerton calls "unsound accomplishments" at the expense of [illegible].

Dr. Frank Billings assures us that "modern clinical medicine embraces such a vast field of knowledge that it is beyond the power of any individual to acquire the necessary learning, experience, and technical skill to practise efficiently in the entire field." This significant declaration is manifestly a confession as regards the apparent tendency toward specialization, against which there are numerous and earnest protests—added years of undergraduate work has encouraged heads of special departments, taking themselves rather too seriously, to magnify the importance of their subjects, as a part of the general curriculum, and with it there comes the demand that a proportionate number of hours be accorded to such instruction without regard for the aims or ideals of the individual student. These protestants insist that in many schools the tendency toward the pyramiding of specialties is inevitably productive of superficiality. As a result students too often are found to have acquired a smattering of disjointed knowledge with minimum facility in its application to their later and more serious tasks. Furthermore, the protestants against specialization proclaim loudly in behalf of the general public, "the party of

the third part" in whose interest, it must be borne in mind, all effort finally centers.

Beyond doubt there has been and always will be an imperative need for men of broad professional training, men well equipped as general practitioners, capable of filling the rôle of "the family doctor," who, though short on metabolism, are long on the humanities; in a word that type of men, who in addition to laboratory and technical training are capable of acquiring what Dr. William Pepper has defined as "the uncanny sense of diagnosis." This applies not only to the isolated, remote communities but to the more densely populated districts as represented by towns and cities of the fourth and fifth magnitude. There is a widespread belief that many capable young men, whose traditions are of the farm, the forest, the mountains, and the mines, after long years devoted to laboratory work, to refinements of diagnosis, and to the superficies of specialism, become hesitant at the end to return to the environment whence they sprung where they are badly needed and where they will find an open door to a successful career.

The result of all this, it is alleged, has been that many country districts have been left open to the inroads of the irregular and the charlatan. Doubtless this need is felt throughout our entire country from New England to California.

The abandonment of medical teaching by many reputable schools and several universities, notably Dartmouth and Bowdoin, because of inability to meet established requirements as Class A schools may in the long run become a matter of profound regret. Accepting this view of the present tendency, overcrowding of large cities and neglect of remote districts, one is led to inquire if we are not drifting unwittingly toward socialized medicine for it is inevitable that medical needs uncared for by the general profession will be assumed as governmental function. This principle once established will surely become universal.

It seems quite within the range of possibilities that sooner or later governing bodies and faculties of medical schools will seriously consider a revision of curricula to the end that more time and better facilities be apportioned to the teaching of what are to be regarded as the fundamentals, anatomy, pathology, general medicine, obstetrics, pediatrics, and surgery. Even the latter may be eliminated from this category, as it is very definitely one of the most highly developed of all specialties. Beyond question this would result in finer co-ordination and greater thoroughness in these branches. Under such a policy clearly defined provision could be made for adequate training in special branches under a post-graduate or extension course, whereby more thorough and exhaustive knowledge could be acquired by those who may elect one or more of these studies. It may be added that under this scheme there would accrue a tremendous saving of time and energy for those who look forward to a career in any given specialty.

THOMAS W. HUNTINGTON.

RETINITIS OF NEPHRITIS; ETIOLOGY

THE etiology of retinitis of nephritis has been a puzzling problem to internists and ophthalmologists for many years. Clinical studies supported by chemical and pathological data have been conducted but the conclusions have been so opposed that it cannot be said that the factors most prominent in the production of retinitis or the manner in which the fundus changes occur have been agreed on. The belief that changes

in the fundi of persons who have nephritis are induced by high blood pressure, arterio sclerosis, and serious impairment of renal function, and are varied in degree and kind according to the seriousness of these conditions, leads to the assumption that all three are intimately concerned; that is, any one may in itself be responsible for the appearance of changes in the retina. Such an assumption seems possible, since observations of selected cases of advanced retinitis show any one of these conditions prominent and the others absent, or present to a negligible degree.

Impairment of renal function, or decompensation of the kidney, usually precedes the appearance of changes in the fundus by a few days or a few weeks. Periods of kidney decompensation are often transitory so far as chemical tests on the blood and urine indicate, and may come and go without any visible changes in the retina at the time or shortly afterward. During a period of renal decompensation there is accumulation of toxic substances in the blood; these have been assumed to be primary elements in retinal damage, and although the exact nature of this damage was not explained, there seemed to be ample clinical evidence to support the assumption. Since it was known that the urea content of the blood increased, the retinal changes were said to be due to azotæmia. Mere absence of a kidney, or the presence of small, contracted kidneys, does not give rise to the grave toxæmia of even a short period of anuria or impaired function. Hence, on the basis of azotæmia, the retinal changes should be definitely related to the severity and duration of renal decompensation, whatever the pathological condition of the kidney may be, but we lack information on this point.

Indeed it is even denied by Schieck and Volhard that renal insufficiency, that is, toxic constituents of the blood, the result of low activity of the kidney, is a factor in the production of retinal changes. Basing conclusions on their observations they assert unequivocally, that rise in blood pressure alone is the factor that produces these changes. Granting that both azotæmia and rise of blood pressure are definitely concerned in the production of the retinal changes, and the two theories are equally well supported, the combined effect of these two factors should bear a certain relationship, modified by a third factor, namely arteriosclerosis. Retinal hæmorrhages, œdema, and exudates are intimately concerned with the blood vessels of the fundus and observation of the walls of these vessels is fundamental in the study of retinitis of nephritis. Primary sclerosis of the retinal arteries without renal disease gives a picture closely resembling that found in nephritis combined with arteriosclerosis or hypertension, but on close observation it is seen to lack the elements that make the characteristic picture of renal disease. Sclerosis of the retinal arteries is found by all observers in a high percentage of cases of retinitis of nephritis, and its importance in the production of the characteristic features of the disease is quite generally accepted. The manner in which sclerosis modifies the œdema and hæmorrhages seen in the retina has not as yet been demonstrated, particularly in cases of hypertension. Primary sclerosis of the arteries may be followed by hypertension, as a result of sclerosis or a totally different condition, and secondary sclerosis from toxæmia or hypertension may be followed by atheroma or senile decadence; then, if renal decompensation with azotæmia arises, a triple combination in production of the retinal picture is presented. Azotæmia occurs without sclerosis and without retinitis, as does high blood pressure; arteriosclerosis may

occur without either azotæmia or hypertension; retinitis is found with only one, any two, or all three of these factors.

The picture, then, must be composite, in which three possible etiological factors are at work at once, each modified to some extent by each.

Chemical study of the ocular fluids during azotæmia or high blood pressure may throw further light on the nature of the retinal changes. Determinations of intracranial pressure and intra-ocular tension should be made in different stages of the disease, because the retinitis that comes from choked disc is so nearly like the retinitis of nephritis that the difference is hard to explain.

The term "albuminuric retinitis" has served to indicate a large group of retinal pictures that are now known to have unrelated etiological backgrounds; some have nothing at all to do with albuminuria. It is well agreed that in no instance is the picture dependent on albuminuria. The term, then, should be avoided in the future and some other words, as "fundus changes in nephritis" or "retinitis of nephritis," be used. The objection has been raised that the changes that occur in the retina are not those of a true retinitis, but, in all probability, they are as truly inflammatory as are the changes in the kidney in chronic nephritis.

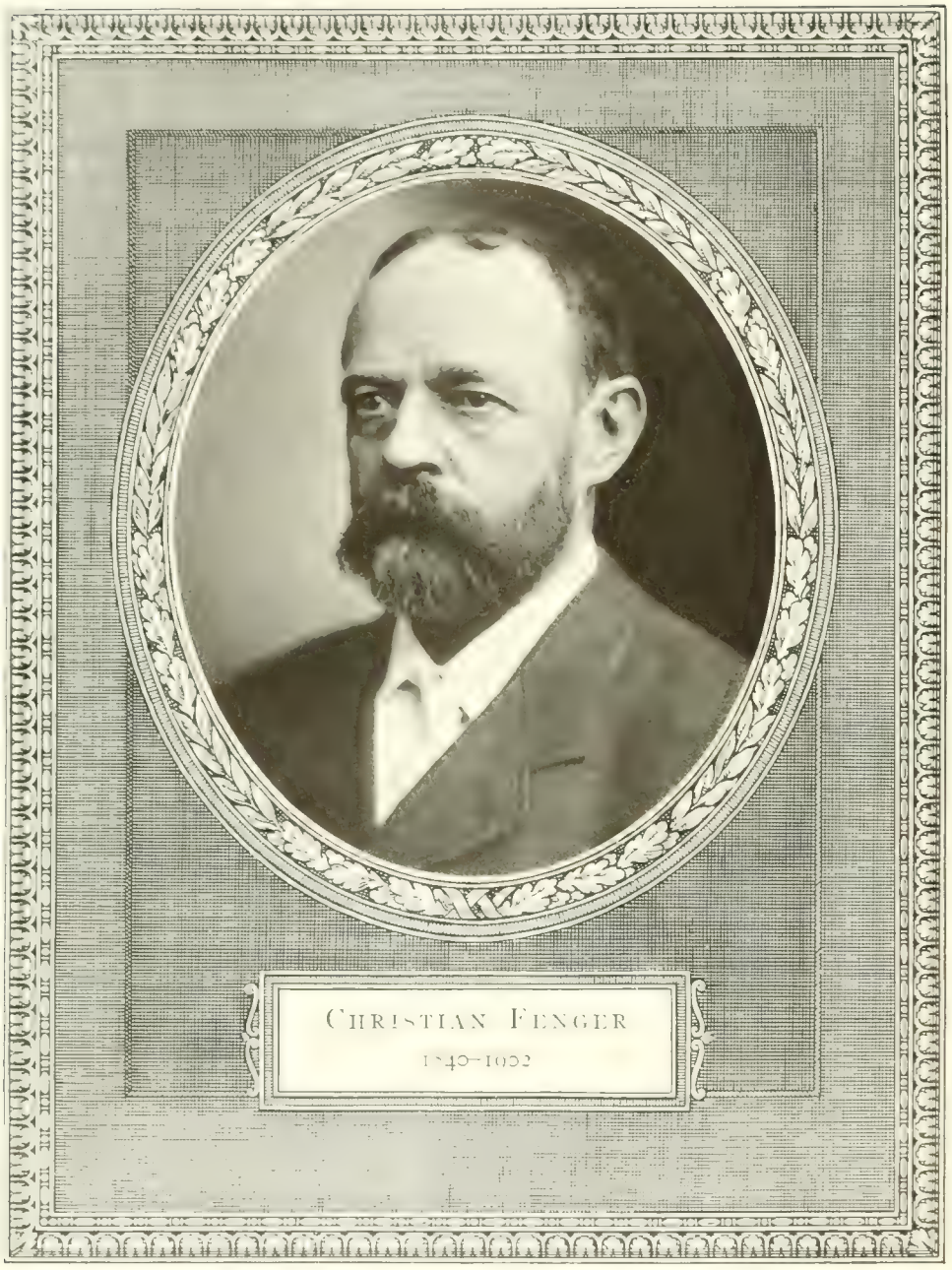
WILLIAM L. BENEDICT.

THE INFLUENCE OF ADIPOSITY ON SURGICAL RESULTS

SIR JAMES PAGET, in writing on senility in 1847, said that senescence is marked either by loss of quantity, as in the emaciation of old age, or by loss of quality, as in the obesity of advancing years. Obesity is closely associated with carbohydrate metabolism, and a considerable percentage of obese persons die from diabetes. The deleterious influence of adiposity on surgical mortality is very considerable. It is not alone a factor of anæsthesia, because there is an unexpected mortality following operations on obese persons when performed under local anæsthetics. Operations, no matter how trivial, should be considered seriously in the face of the obesity of the old, which must be regarded as a process of senility or degeneration, and, in the adiposity of the young and middle-aged, operations of expediency should not be lightly undertaken. Necessary operations, however, must be performed on the obese patient, and so far as possible, under local anæsthesia.

The greater number of necessary operations on obese patients are not emergency, and often a reduction in weight of 10 or 15 per cent will place the patient in excellent condition for operation, other things being equal. The reduction of weight before abdominal operation relieves the intra-abdominal tension; in the absence of infection, an obese patient thus prepared seldom dies from conditions that a person of ordinary weight would recover from. However, the weight should not be too greatly or too rapidly reduced, as debilitation may result. Methods for the reduction of weight are best carried out by an experienced internist who is interested in diabetes. It is sometimes advisable, if rapid reduction has been necessary, to give the patient a fairly full diet for several days immediately preceding operation.

WILLIAM J. MAYO.



CHRISTIAN FENGER

1840–1932

MASTER SURGEONS OF AMERICA

CHRISTIAN FENGER

CHRISTIAN FENGER was born at Breininggaard [illegible] Denmark, November 3, 1840. He was one of twelve children born to Kammerrand Hans Fritz Fenger and Frederrike Mathilde Fjelstrup, both representatives of excellent families and well-to-do farmers. All of the sons secured excellent educational advantages, but with self-help. In 1851 the boy Christian Fenger entered the Herlufsholm school and graduated therefrom in 1859. He had a great love for the natural sciences and entered the Polyteknisk Läreanstalt, beginning the course in civil engineering. After one year his father induced him to take up the study of medicine. In 1860 he passed his first examination in anatomy, zoology, chemistry, and botany and soon thereafter passed an examination in philosophy, *cum laude*. He partly earned his way by teaching in the Melchior high school and by tutoring dental and medical students. During the war between Denmark and Prussia, he became an assistant surgeon at the Augustenborg Lazareth. In 1865 he again took up the study of medicine and in this year passed an examination to practice medicine. During the next 3 years he acted as an assistant to Dr. Villem Meyer in clinical otology and collaborated in the investigation of adenoid vegetations in the nasopharynx. In 1869 he was appointed interne in the Royal Frederik's Hospital for a two-year period. During this period he wrote a prize essay entitled "Concerning Subperiosteal Operations and Evidement," and also made fundamental experiments concerning gunshot wounds of horses at the Royal Veterinary College, and invented instruments for locating and extracting bullets from tissues. This experimental work was rewarded by a grant from the Royal Danish Ministry of War which enabled Fenger to take part in the Franco-German War. In January, 1871, he was appointed by Professor Socin, of Basel, to serve in the Red Cross International Ambulance and assigned to duty on the battlefield of Bourtaki-Werden (Haute-Saône). His experience in the war enabled him to write a report on the endoscopy of gunshot wounds. Immediately after the war he studied pathological anatomy and attended the surgical clinics at Vienna, and on his return to Denmark was appointed prosector to the Communehospital. In this position he continued until the end of 1874 during which time he took advantage of the splendid opportunities for investigation in pathology and morbid anatomy which was evidenced by the

important papers he completed on "Cancer of the Stomach," "Acute Hydronephrosis," "Gonorrhœal Rheumatism," "Endoscopy of Urethra," "Stenosis of Ostium Pulmonale," and others. The article on cancer of the stomach was written after painstaking investigation which included the explanation of the pain in cancer of the stomach as due to the involvement of the end-filaments of the pneumogastric nerve in the cancer mass. This was his thesis for the degree of Doctor of Medicine which was granted in 1874, approximately 13 years after beginning the study of medicine.

In the winter of 1874–5, he was appointed docent in pathological anatomy and became a candidate for the professorship of pathology upon the death of Professor Rasmussen. He was prepared to take part in the competition for this position, but the place was finally given to Professor Carl Lange by appointment. Fenger looked forward to an academic career in pathology and was disappointed that he was not permitted to compete for the place. However he accepted the situation philosophically and finally determined to make surgery his life's work, for which his long and extensive experience and investigation of morbid anatomy and pathology especially prepared him. He therefore decided to seek outside of Denmark the opportunities which would enable him to dedicate himself to surgery. In 1875 he went to Alexandria, Egypt, to assume the practice of his brother, Dr. Sophus Fenger, while the latter visited Denmark. On the return of his brother he located in Cairo where he resided with a friend, Dr. Bull. Here he secured a salaried position as *Médecin du Quartier de Kalifa*, under the chief of medical affairs in Cairo, Dr. Ahata Bey. In this position he investigated trachoma in the children of the public schools, and an epidemic disease of horses and mules which prevailed in Egypt following the war with Abyssinia in 1875. In 1876 he suffered from dysentery including an infection of the liver which interrupted the investigations he was making upon hæmatobium bilharzii. The winter of 1876–7 he spent in Mentone, France, and recovered his health. After his return to Cairo in the spring of 1877, the infection of the liver reappeared and he determined to seek a temperate climate. He had become acquainted with some American Army officers, among them Major Irgens, who persuaded Fenger to accompany him to Bloomington, Illinois. In June, 1877, he resigned his position with the Egyptian government and arrived in the United States in the fall of that year.

CAREER IN THE UNITED STATES

On a visit to Chicago soon after his arrival in the country, he was persuaded by his countryman and friend, Dr. S. J. Jacobson, to locate in Chicago. Dr. Jacobson introduced Fenger to the members of the staff of the Cook County Hospital and he was invited to conduct a few autopsies at that institution. His scientific demonstration of pathological anatomy created such an impression that Dr. Isaac N Danforth, who held the appointment of pathologist to Cook County

Hospital, immediately tendered his resignation for the purpose of making the position available to Fenger. From the spring of 1878 until 1893, Fenger was the chief pathologist at the County Hospital; for 14 or 15 years the autopsy room at the County Hospital was the Mecca of medical students, internes and members of the medical profession of Chicago who for the first time in the medical history of the Middle West had an opportunity to witness scientifically conducted autopsies and to learn the fundamentals of morbid anatomy and pathology.

In 1879, Fenger served in the surgical wards for the various members of the surgical staff of the hospital when they were absent from the city on vacations. This surgical service gave him the opportunity to introduce Listerism—antiseptic surgery—in the Middle West. In 1880 Fenger secured appointment with a regular surgical service in the County Hospital in which he continued for the next 12 years.

From 1880 to 1884 he was curator of Rush Medical College Museum; in 1884 he was appointed professor of surgery in the College of Physicians and Surgeons; in 1893 he became professor of surgery in the Northwestern University Medical School, and in 1899 he became professor of surgery in Rush Medical College affiliated with the University of Chicago. He was surgeon in chief of the Passavant Memorial Hospital, the German Hospital of Chicago, and the Lutheran Tabitha Hospital from the time they were organized until his death. From 1893 to 1899 he was attending surgeon at the Mercy Hospital, Chicago, and from 1899 until his death, he was attending surgeon at the Presbyterian Hospital.

He was a member of the Chicago Medical Society, its president in 1901; the Chicago Surgical Society; the Illinois State Medical Association; the American Medical Association; and the American Surgical Association, its vice-president in 1895.

He was a prolific writer upon subjects relating to surgery, special pathology, and diagnosis. These papers were published under the joint editorship of Drs. L. Hektoen and C. G. Buford.[1]

Soon after he located in Chicago, Fenger married Caroline Sophie Abilgaard, who was born in Denmark and came to the United States with her parents when 5 years of age. This happy union was characterized by mutual, sympathetic understanding. Two children were born to them, a son, Frederick A., who graduated at Cornell University and qualified as a marine architect, and a daughter, Augusta Maria.

FENGER THE SCIENTIST AND MAN

In the foregoing the writer has given bare statements of the struggles for education, the professional positions held and other data of historical interest. The outstanding features presented are the evidences of the purposeful industry of the man. Undismayed by difficulties and obstructions to the attainment of

[1] The Collected Works of Christian Fenger. Philadelphia: W. F. [illegible]

objectives, he won success in practically every project undertaken. His knowledge of morbid anatomy and of pathology was phenomenal for that day and was attained by unremitting energy during his life in Denmark and Egypt and his earlier experience in the United States. This knowledge of pathology and of morbid anatomy made him one of the great surgeons of his time. He never became a brilliant operator, but what he lacked in operating skill was more than compensated for by thoroughness and knowledge of pathology. In diagnosis he was unsurpassed by any of his living contemporaries. He spoke five or more modern languages, but did not possess a ready command of any language. Nevertheless, he was a great teacher and though his speech was usually marked by halting words, he was able to impart knowledge to others with greater clearness than most teachers with fluent speech. He was especially fond of young men who showed by their every day lives that they had a thirst for knowledge and expressed this by purposeful, enduring work. He spent hours of his valuable time, both of the day and night, in the instruction of young medical men; in these interesting conferences he frequently forgot the passage of time in the apparent joy of teaching. It was through his influence that many of the young medical men of the period from 1880 to 1900 visited the clinics of Germany, Austria, France, and England, and later became leaders in their chosen fields of work in the United States. While Fenger loved above every other thing in his professional life to help young men who were not afraid to work, he expressed an impatience with the frivolous and indolent men with whom he came in contact. Always he had the courage of his convictions and expressed them with blunt words which sometimes gave those unacquainted with him the idea of unfriendliness. But no man the writer has ever known was freer of envy or jealousy of others. Always he availed himself of every opportunity to express appreciation of the work of other men, provided it was characterized by honesty and efficiency. He was honest, intellectually and professionally. He was sincere and by nature simple in his deportment and daily life. He was free from cupidity and sympathetic with the poor; to each patient he applied all of the knowledge he possessed and all of the time necessary disregardful of financial reward.

Fenger lived in Chicago 24 years. During that period of time he exerted an influence in scientific medicine unequalled by any other individual. It was due to his influence and particularly as a pathologist that there developed such men as Nicholas Senn, John B. Murphy, William J. Mayo, Lewis L. McArthur, and many others celebrated as great surgeons, and Ludvig Hektoen, E. R. LeCount, H. G. Wells, and others recognized as great pathologists, and many practitioners of internal medicine throughout the Middle West and in Chicago. This splendid influence of Fenger was generally recognized as evidenced by the testimonial banquet tendered him by several hundred members of the profession, many of them from distant states on the sixtieth anniversary of his birth. The Fenger

Memorial Association, organized soon after his death, perpetuates his memory through scientific research carried on through the income of an endowment fund.

His home life was ideal and happy. Both he and Mrs. Fenger loved art, music and literature, and the society of cultured friends. Christian Fenger passed from this life on March 7, 1902, but though 20 years have passed, he lives today in the hearts and minds of hundreds of physicians and surgeons who were proud to call him master; and he will continue to live through other generations by the work of his students and his pupils' students.

FRANK BILLINGS.

TRANSACTIONS OF SOCIETIES

CHICAGO SURGICAL SOCIETY

Regular Meeting Held April 7, 1922, Dr. Dean D. Lewis, Presiding

AUTOGENOUS VERSUS HETEROGENOUS BONE PEGS

Dr. George de Tarnowsky read a paper entitled: "Autogenous Versus Heterogenous Bone Pegs." (See p. 342.)

DISCUSSION

Dr. Charles Davison: It seems to me that it has been satisfactorily proven, both experimentally and clinically, that autogenous bone transplants, when properly placed are not treated as foreign bodies by the tissues and that they maintain sufficient viability to graft to the adjacent bone and become a part of it. The use of autogenous bone for transplantation has its objection in the fact that it robs the patient of bone from some other location.

I saw some of Dr. Tarnowsky's work at Cook County Hospital. I tried to follow up the cases after they left the hospital, but was not able to keep in touch with them.

At the University of Illinois College of Medicine we have been doing experimental work on a series of dogs to try out the use of boiled beef-bone transplants placed in the medullary canal of the humerus after fracture. We used young dogs. We used the same operating room surroundings and technique as used for human patients. The dogs were killed at different periods after operation, up to about 450 days, for comparison of the processes of repair. Roentgenograms were systematically taken. Notwithstanding our extreme care, the infections were many and practically every dog that became infected died. The dogs that lived to be sacrificed showed an average condition at different periods as follows:

1. The transplant was held in position in both fragments by new bone between the endosteum and the transplant, resembling the new bone found around the edge of a Lane plate, but there was no callus uniting the ends of the fragments. The fracture was only supported by the beef-bone transplant.

2. The transplant was entirely disintegrated between the ends of the fragments of the fractured bone—freeing them from the mechanical immobilization of the beef-bone transplant.

3. Fibrous union of the fragments was usually in poor condition.

4. Bony union of the fragments in mal-position took place at a very late date with poor function.

We are still working at the problem and hope to present a more complete report at a later date.

Dr. H. M. Richter: I feel that Dr. Tarnowsky's opening remarks necessitate my saying a word. I hesitate to do so, but I desire to place this matter on a definite chronological basis.

December 10, 1914, I operated on a fractured femur at Mt. Sinai Hospital, after being unable to reduce it in any other way, and put in a beef-bone dowel. Dr. Schrager assisted in the operation. A few weeks later, at the Cook County Hospital, I operated on a fracture of the femur, again using a beef-bone dowel. During the period of 7 years that has elapsed since then, I have used the beef-bone dowel on several fractures of the femur. During the operation on the second case, Dr. Tarnowsky was present and asked me whether it was original work, and he suggested that my work should be published. I have reminded Dr. Tarnowsky that four of his original six cases came in on my service and were placed at his disposal as a matter of courtesy.

In 1915, after I had done my first two cases, one of Lexer's assistants at the Jena clinic came out with an article on the use of horn as a means of fixing joints in Lexer's arthroplasties. I secured a number of beef and ram's horns at the time, worked with them and made dowels of them. We had a motor machine to do the work. We made a number of dowels of different sizes and compared them with the bone dowels. They had some advantages over bone dowels. They were said to be more rapidly absorbed, and because of their epithelial structure, I should judge they would be.

I feel that heterogenous materials, bone, ivory, horn, or what not, should have as their purpose one thing, and that is, fixation of the fragments long enough to get union; that they need not last longer than a few weeks. They are objectionable if they interfere with union. Horn can be more readily used. It is much easier to cut. One can cut it with a knife when hot, or with bone-cutting forceps. It has an advantage over bone. It has the disadvantage of not being accessible to all of us. We can get beef bone more easily.

Dr. D. B. Phemister: I understand that Drs. Tarnowsky and Richter believe that all of the living autogenous transplant undergoes necrosis. No one who has worked histologically on the problem in recent years agrees with this view, the general opinion being that unossified osteogenetic elements sur-

vive, if favorably placed for reception of nutrition, proliferate, and participate in the establishment of union and transformation in the compact portion of the transplant which undergoes necrosis. If an entire bone, as a metatarsal or metacarpal, is excised and reinserted, it takes, and in 3 months one can scarcely tell that it has ever been excised. If, however, it is boiled before reinsertion, infection very frequently develops about it and the wound frequently opens up; if not, the boiled transplant is gradually absorbed.

When fragment ends are adequately apposed and fixation alone is required, beef bone or ivory may act quite as satisfactorily as a living graft, but if there is defective osteogenesis or bony gap to be bridged, a living transplant should always be used

In cases of non-union with marked atrophy, I have used with success a heavy graft which is inlaid and fills out the medullary canal and grooves in the cortex and stands above the surface of the bone for a considerable distance. This gives fixation by a heavy graft which will not break and which has a good chance to take.

Dr. Kellogg Speed: I have operated on three fractured femurs attempting to obtain a repair by means of beef-bone implants or intramedullary transplants. Two were successes, and one was a failure. None was infected. One patient was a young girl who had a fracture of both femora. One femur failed to unite and the other side succeeded, both were without infection. Why this was I do not know.

Recently I have operated upon a patient who had a fracture of both bones of the forearm, which was formerly treated by one of the fellows of this society in which he transplanted in the medullary cavity of the forearm bones, ram's horn or beef horn. This was followed by non-union in both bones but no sepsis. An X-ray picture of the ram's horn, taken many months after the original implantation, showed no change, no absorption. It retained its square edges and apparently had undergone very little absorption after 6 months. There was non-union and fibrosis covered over the fragments. I believe beef bone has a use. I believe live bone transplants will live and regenerate, especially the unossified elements which are supplied with sustenance. There are occasions when one wants to use beef bone, when the patient is too young, or for any other reason when it is impossible to take out his own bone and use it as in extensive or multiple operations where haste is a factor The prolongation of the operation which may cause shock is inadvisable. Beef bone is applicable to that type of case. It is used, however, only as a fixation agent, and if one drives the transplant into the intramedullary cavity and plugs that cavity, non-union may follow. For that reason I have given up the intramedullary transplant altogether. I never use it any more. I employ the inlay method or one similar to it, using live bone. I think the time will come when the insertion of live or dead bone into the intramedullary cavity will be abandoned

Dr. Dean W. [illegible] Dr. Eugene Brown of St. Louis [illegible] live [illegible] bone, and [illegible] onstrate that autogenous grafts live. Based upon [illegible] tion be [illegible] At a [illegible] leaving the [illegible] small blood [illegible] during the [illegible] when the graft is finally transplanted at the second stage of the operation [illegible] producing new callus, and in prime condition to re-establish its intrinsic nutritional blood supply *via* the new and [illegible] It is obviously impossible [illegible] this function which should prove valuable in the treatment of a group of selected cases in which the osteogenetic function has been found deficient.

Dr. Dean Lewis: I [illegible] the work of Dr. [illegible] by Dr. Cobb. [illegible] had had arthritis of the [illegible] been operated on three times. I operated on him a fourth time. When I saw the case a week after the operation I found that the intramedullary graft had slipped—had come out of the upper fragment—and I put on a cast and sent him home. He came back 14 months after that without [illegible] time using an intramedullary peg, as the lower fragment was solidly fixed. I chipped off the upper end because it was not in contact with the upper fragment, and found there live bone cells. In the center of that graft were live cells which replaced some of the dead bone. This graft was placed in the marrow cavity, as Dr. Brooks suggested, and a small Lane plate put on. That patient has had union for 6 years I have had other cases of [illegible] and the transplant [illegible] sequestrum [illegible] cannot understand the [illegible] that sequestration is apt to occur after a transplantation. I have seen sequestration repeatedly following infection. Dead bone will form sequestra. The transplant forms a [illegible] In my case the sequestrum was taken from the upper fragment but there [illegible] fragment. I [illegible] in place and the man secured firm union.

What Dr. Brooks has demonstrated experimentally has been verified clinically. A transplant in position offers one of the best prospects of cure for fractures. I am certain that sequestrum formation after infection [illegible] rence.

Dr. G[illegible] I [illegible] heard repeatedly of Dr. Davison's experiments on dogs. We all [illegible] infected very readily, and that there will always be [illegible] or cats.

against heterogenous bone pegs and in favor of living bone transplants, I feel just as much convinced as before I read my paper, that both living transplants and bone pegs are foreign bodies when introduced into the intramedullary cavity or as inlays. A bone transplant cannot be taken from one part of the body, completely disconnected from its nerve and blood supply, and transplanted to some other part of the body and remain a living entity. It is to be hoped that this question will be settled.

Dr. Lewis said that a sequestrum cannot form except in the presence of living bone. I do not grasp how he can explain the particular case I have referred to, in which, after 7 years a distinct sequestrum shows. I made use of beef bone in this case and it was certainly dead when transplanted. It has eburnated. It has not been absorbed for years.

I agree with Dr. Richter that we must not displace bone marrow any more than we can possibly help. We must not hammer the peg in tightly. That is a mistake. I put in two or three screws or ivory nails to hold the bone peg in place, and even then the implanted pegs may slip, and in spite of the fact that the limb is immobilized you may find that in some way the pegs have slipped an inch or an inch and a half up or down. I have no explanation for that, but in order to insure against slipping I advise putting in one screw proximally and distally. The peg must come in firm contact with the living and freshened bone, both proximally and distally.

Regarding the utility of using heterogenous beef bone for the filling in of defects, I will say that British surgeons have reported a number of successful cases, where from 4 to 10 centimeters have been filled in with heterogenous beef-bone peg.

I hope in a few years we will take this matter up again and possibly come to some understanding.

Dr. Albert H. Montgomery read a paper on "Gastrojejunal Ulcers."

ASSOCIATED PATHOLOGY OF GALL-BLADDER DISEASE WITH A FURTHER PLEA FOR CHOLECYSTECTOMY

Dr. Frank D. Moore read a paper entitled "Associated Pathology of Gall-Bladder Disease with a Further Plea for Cholecystectomy." (See p. 338.)

DISCUSSION

Dr. William M. Harsha: Dr. Moore has certainly given us a wide field to consider in connection with gall-bladder pathology. It is hard for one to think about the subject in terms of such numerous pathological conditions as he has described; yet when you analyze it, there is probably no exaggeration. The early pathology of the gall bladder is one of the things that is most difficult to determine. That has been my experience. Even when we have the abdomen open we are often unable to tell whether the gall bladder is diseased. Sometimes cultures have shown infection when there was no macroscopic appearance of any sort to indicate operation, so that while the subject has been written on a great deal of late it is yet far from settled and is deserving of very close study. Our greatest need is to settle on some satisfactory method or methods of determining when we have a pathological gall bladder. The procedure of Lyon while promising, I do not believe has been generally adopted. I believe it worthy of a thorough trial. A careful history and a careful physical examination, if we can eliminate the hyperæsthesia of the neurotic individual, continue to be our chief reliance, i.e., the clinical history and physical findings.

The X-ray gives us little, if anything, of importance on the earlier pathology of the gall bladder. It helps us to exclude ulcer, gastric or duodenal, but it helps us little in determining positively any pathology of the gall bladder.

As to the desirability of taking out the gall bladder or draining it, there is a great diversity of opinion. Some very good authorities, like Willis, of Richmond, advocate a drainage operation in advanced pathological conditions of the gall bladder, because of the danger to life, and cholecystectomy when we have very slight pathology because of the danger from adhesions following drainage. I do not agree that the subsequent troubles from adhesions are so formidable as most writers claim. I believe that with careful handling, and with a snug suture of the gall bladder properly placed around the tube, we do not usually have formidable adhesions.

With advanced pathology, where the lymphatics are involved, and where there is hepatitis or cholangeitis, drainage is much safer, and is attended with less mortality. We know that in infections of the extremities, with abscess formation, the lymphatics are involved, yet with drainage they resolve and disappear without amputation, so that I believe that those of us who have been using drainage of the gall bladder in the past, with the view of cleaning up the tracts have justification for that practice. I believe in many cases drainage of 3 or 4 weeks will clear up lymphangitis, cholangeitis, the liver will assume its normal function, the lymphatics will clear up, and we will have an organ left that has some function. I think it is fairly well agreed that the function of the gall bladder is to store and concentrate the bile. Bile coming out of the cystic duct is entirely different from that coming from the hepatic duct. To practice total ablation of gall bladders, whether slightly diseased or which may not be diseased at all, is certainly not best for the patient.

Personally, I would rather have an adhesion than to have my gall bladder taken out for a very slight pathology. If it can be done safely, I think cholecystectomy is necessary in many cases where the walls of the gall bladder are clearly diseased, thick, or of the strawberry type. However, I do not approve of the widespread tendency to make cholecystectomy the operation of choice. The decision should be made by the surgeon at the operation.

Dr. John R. Hargar: From the reading of this subject and hearing it discussed, it is very easy for one to draw the conclusion that the question is far from being settled. We all agree that pathology in the upper abdomen is frequently associated with the gall bladder, and it is quite likely that the gall-bladder trouble is at times secondary to appendix trouble, and we know a great many times [illegible] ary to a gall bladder condition. However, it seems rather radical to talk about removing such a large percentage of gall bladders.

Dr. Harsha has well said that the diagnosis in the early stages of gall-bladder conditions is not easy. Individuals so frequently suffer more or less from gall-bladder conditions and a diagnosis is not made. In this connection we might use the analogy of a joint cavity or the urinary bladder. An acute synovitis is capable of clearing up and returning to a normal condition even in the event of suppuration of the joint. After drainage we get apparently a normal joint. So in the urinary bladder where there is natural drainage we get, after all types of inflammation of that bladder, a return to a practically normal condition. In contradistinction to that, one of our best genito urinary men made this statement a year or two ago, namely, that he firmly believes that when the urinary tract is chronically infected, it is always infected; and that it never does clear up entirely. A great many cases light up from time to time after various predisposing factors are manifest.

One of our men said here a few months ago in discussing this subject, it would seem absurd to remove the urinary bladder because it was full of stones or was inflamed. Furthermore, in the case of a joint, if the infection is limited to the synovial membrane, the joint frequently returns to a normal condition. And so it may be with the gall bladder, if the inflammation is slight, it will return to a normal condition. With an infection about the joint cavity, in the periarticular tissues, the joint is prone not to return to a normal condition but the pathological process is apt to remain indefinitely. If we can picture a gall bladder in the same condition with the infection in the wall of the gall bladder, it thus becomes chronic, and the gall bladder will not return to a normal condition. Before we consider the removal of the gall bladder, we must discuss this question, namely, pancreatitis, which is frequently associated with cholecystitis. We were taught a few years ago that the treatment of acute pancreatitis consisted of drainage of the gall bladder. If the gall bladder is removed, what assurance have we that the individual will not [illegible] pancreatitis but it seems logical to suppose that an acute cholangeitis may be associated with an acute pancreatitis. If we have an acute pancreatitis [illegible] the gall bladder [illegible] position. True enough, a gall bladder that is the seat of an old inflammation and contains gall stones, or is of the thickened or strawberry type, should be removed. When I think of this question I think of an instance where [illegible] on the bench [illegible] the pathologist discussing a postmortem examination. I cannot recall the instance where the peculiar pathology he was discussing obtained, but he said this: "It may and it may not, then again it might." I think oftentimes when we are going to operate on the gall bladder, we think that same way, we may remove this organ or we may not, but then again we [illegible] I believe the removing the gall bladder [illegible] tirely on a man's surgical judgment. Good surgical judgment is the [illegible] There are many cases in which the gall bladder should not be removed, and there are many others in which it should be removed, and [illegible] surgical judgment when in the abdomen to treat these gall bladders by drainage or removal, it is a safe and sound method.

Dr. Moore (closing): I agree with Dr. Harsha that it is very essential and sometimes very difficult to make a diagnosis, but I believe that by a closer observation of the clinical history in the [illegible] will be able to do so.

In regard to drainage, I am of the opinion that in most cases we drain only the surface without relieving the deeper or interstitial layers, and a gall bladder that has been drained [illegible] weeks to 3 months can never return to normal [illegible] whatever that may be, whether it be that of a reservoir or as a pressure-gauge regulating the flow of bile into the [illegible]

We have all seen in secondary operations nothing left but useless tracts or pathological remnants [illegible] nothing like a normal gall bladder.

With regard to pathology, the object of my paper is to emphasize the importance of early diagnosis and of early operation to prevent secondary pathology. [illegible] the gall [illegible] I think it should be [illegible]

BOOK REVIEWS

CRITIQUE OF NEW BOOKS IN SURGERY

ALTHOUGH essentially an atlas the first four chapters of *The Pathological Gall Bladder*[1] are devoted to a general discussion of roentgenography in gall-bladder disease whether or not calculi are present. The authors' technique is given in detail; the basis for interpreting the results is concisely stated, and a statistical report given which shows about 88 per cent of correct inferences in the last 128 operated cases

Both the technique and the interpretation in this work must be especially skillful since the shadows produced are of the most delicate sort. A thoroughgoing technique may require more than a dozen exposures before films of a quality adequate for diagnosis are obtained. Particularly is this true when attempting to make inference regarding a diseased gall bladder in which no lime-containing stones are present. The technique is primarily roentgenographic for it has been found that the fluoroscopic screen is of use only in the detection of signs of pressure of the gall bladder on neighboring barium-filled viscera.

The body of the atlas is divided into three sections as follows: I. Pathologic Gall Bladders Containing Stones; II. The Visible Pathologic Gall Bladder; III. The Pathological Gall Bladder: Indirect Evidence.

This contains every conceivable variation in the structures of the right upper quadrant seen in gall-bladder disease. The authors' contention regarding the visibility of the diseased gall bladder is well vindicated. Nowhere is to be seen the rich array of roentgenographic material on this subject. To one who is seeking to follow up this work in which the authors are pioneers, the atlas is invaluable for comparison and reference. While no attempt is made to give a brief of the clinical history of the cases illustrated, as a purely roentgenographic production, the atlas is without parallel.

Aside from the content, the atlas is a masterpiece of bookmaking. Laid out lavishly and finished to perfection, there is left nothing to the imagination in illustrating the authors' points. Considering the delicate structures dealt with, it is nothing short of marvelous how well these structures are shown in half tone and photographic copies. The description of the plates is in English, French, and Spanish.

HOLLIS E. POTTER.

[illegible]

THE second edition of this excellent work[1] shows many minor changes, few topics having escaped revision in some particulars. Certain chapters have been enlarged and new references and data collected since the first edition went to press have been added. Chapters on tumors of bone and on neurofibromatosis have been rewritten in large part, the changes made being such as would come with a review of such a comprehensive subject in the brief period of two years. Emphasis and space continue to be given to a delineation of varieties in tumor development, to tracing the mode of neoplastic origin and growth, and to distinguishing the different forms and situations of growths of the same general variety. Essentially the volume is the work of a pathologist, yet so arranged and with the subject matter so presented as to be of pre-eminent service to the clinician. It were platitudinous to say that this work will become a classic, but today it forms the most thorough and informing treatise on neoplasms in our language. CAREY CULBERTSON.

THIS interesting monograph[2] is a critical and suggestive résumé of the author's work on the gastro-intestinal tract which has been reported during the past few years in the *American Journal of Physiology* and other journals. According to his conception the most important factors in controlling the movement of intestinal contents are, first, the inherent property of smooth muscle to undergo rhythmic contractions and, second, a gradation in the strength of those contractions from the upper to the lower end of the digestive tract. Various extrinsic influences may start up and augment these normal contractions; for example, stretching from the pressure of food or gas, irritation from inflammatory conditions, and chemical irritation from drugs.

The author emphasizes the fact that although the muscular wall of the gastro-intestinal tract consists entirely of smooth muscle, there are great differences between the musculature in different parts of the tract, depending on the different requirements put upon it. For example, the muscle of the cardiac end of the stomach is soft "like coagulated fibrin; that in the pyloric antrum is tough like

[1] Neoplastic Diseases; a Treatise on Tumors. 2d. ed. By James Ewing, M.D., Sc. D. Philadelphia and London: W. B. Saunders Company, 1922.

[2] [illegible]

they show different types of rhythmic activity. There are also different types of peristaltic activity in the stomach. [illegible] waves of contraction starting as shallow ripples near the cardia and breaking into deep waves at the antrum, hunger contractions during the first stages of starvation, etc. In the small bowel there are rhythmic movements which move the intestinal content back and forth from one end of a short loop to the other, without forwarding it along the bowel. The forwarding is done by peristaltic rushes which usually arise in the duodenum, perhaps as very shallow ripples, and increase in intensity from above downward. These rush waves are stopped by active contractions which arise in the region of the ileocecal valve. In the colon the muscle is sluggish and contraction waves appear only at long intervals. Reverse peristalsis may appear in any part of the tract, but is usually the result of irritation or disease.

The rhythmic contractions of the smooth muscle, which form the essential element in these different types of muscular activity, show a definite gradation from the upper to the lower part of the tract. This depends upon a similar gradient in the metabolic rate, as shown experimentally by a determination of the carbon dioxide output and the oxygen consumption of the muscle in different parts of the tract. The author believes there are similar gradients in the catalase content of the tissues, in the muscle tone, and in its irritability.

Theoretically, any condition that would tend to disturb the normal gradient would lead to some [illegible] the rate of rhythmic contraction, the irritability [illegible] the gradient, possibly more in some parts than in others [illegible] and may act differently in different parts of the [illegible] current resulting [illegible] dix would be increased in rate and in force. Theoretically [illegible] this point, and lead to reverse peri[illegible] lesion with nausea and vomiting, and to hyperactive peristalsis below with diarrhœa. Actually such is [illegible].

To describe the physiology of the different [illegible] under various abnormal influences as set forth in this monograph, would unduly prolong a brief review. The author fittingly says the value of a theory depends on its ability to explain and find a place for new facts, and the reader, I feel, will agree that Alvarez's conception of the physiology of the gastro-intestinal tract is helpful, suggestive, and of [illegible] basic problems of nutrition, digestion, and gastro-intestinal [illegible]

CORRESPONDENCE

PRACTICAL METHOD OF FIXATION IN FRACTURES OF THE MANDIBLE

To the Editor: I feel that a word of explanation is necessary in regard to my paper in the May issue of SURGERY, GYNECOLOGY AND OBSTETRICS, on "Treatment of Fractures of the Mandible," which may appear to give credit for originating a principle of treatment to those who are not entitled to it and who I am sure would not for one moment claim this originality. The *principle* in question is that of fixation of the fracture of the mandible by means of wire ligatures passed from the upper to the lower [illegible] Dr. Thomas L. Gilmer, of Chicago, who first pointed out its value in [illegible] September, 1887. All methods subsequently published, including the one described in my article, in which this principle is utilized, are but modifications of the method of Gilmer.

[illegible] H. Ivy.

Philadelphia.

AMERICAN COLLEGE OF SURGEONS

MEXICO

By WILLIAM J. MAYO, M.D., F.A.C.S., Rochester, Minnesota

THE distance to the City of Mexico from the cities east of the Mississippi River equals that to southern California and the time required to make the two journeys is approximately the same. While San Antonio is 150 miles north of the Border, this is the city rather than Laredo on the Border from which one starts the journey into the country of our southern neighbor. San Antonio is a beautiful city, progressive, and up to date, with nearly 200,000 inhabitants. Its medical profession is of the best, its newspapers are of unusual strength, and its public spirit is shown strikingly in the beautiful parks that make it one of the most attractive of American cities. Remarkable architectural evidences of the old Spanish occupation are close at hand. The Alamo, of historic fame, is a well-preserved ruin of the Franciscan mission, built in 1772, in which in 1836, a group of 183 Americans to the last man died at their posts when besieged for 13 days by General Santa Anna's Mexican army. Among these gallant defenders were Colonel James Bowie, whose name is perpetuated by a remarkable hunting knife which let the light of day into much human anatomy in frontier times, and David Crockett, the bold scout, loved in our boyhood days, and characterized by his slogan, "Be sure you are right, before you blaze away," which might well face the surgeon from the wall of the surgical amphitheater.

On crossing the Rio Grande River, one enters a truly foreign country and an ancient civilization. The contour of the land changes, rising gradually to the great central plateau of Mexico, in the northern part of which is situated the city of Monterey. On the line of the railroad near Monterey was fought the battle of Buena Vista, the most brilliant engagement in the war with Mexico of 1845, and one of the most brilliantly fought battles in all history. Here General Zachary Taylor with less than 5,000 men, fighting against terrible odds, strategically defeated General Santa Anna with more than 20,000 men. Taylor's army was on the defensive between two mountains, his left on the mountain side, his right in a series of arroyos cut by flood waters. Santa Anna's troops rushed down on the right and were brought to confusion by the arroyos, which, like the sunken road at Waterloo, brought victory from what seemed certain defeat.

Pullman service beyond the Border is good and the journey to Mexico City is made very comfortably. The city is beautiful; it has with its suburbs 1,000,000 inhabitants, and it lies in the center of a well-watered valley more than 7,000 feet above sea level. Mexico City is to Mexico what Paris is to France, and as the capitol city of the Mexican Federal District, what Washington is to the United States. Guadalajara, with about the elevation and population of Denver, is the second city in Mexico. It also lies in a valley of great richness; its climate varies only a few degrees during the entire year. The rainy season in this part of the country begins in June and ends in September, the downpour coming at about the same time each afternoon. The third city of Mexico, Puebla, is beautiful, and very attractive to tourists.

The Mexicans are our nearest neighbors on the south. We should live with them as understandingly and as peaceably as with our Canadian friends on the north, but there are many reasons why this has been difficult. Canadians and Americans are essentially the same people with the same historical Anglo-Saxon background. The Mexicans' civilization is Latin, and the basis of the population, Indian.

HISTORICAL

As an aid in understanding the nature of these difficulties and the manner of overcoming them, historical events should be recalled. Mexico, as a state under Spanish rule, antedates the oldest settlement of the French and English in the New World. The conquest of the empire of the Aztecs in 1520, by the brave and hardy Spanish buccaneer, Cortez, followed closely the discovery

of America. The vice-regal government established by Charles V of Spain flourished for a time and at the middle of the sixteenth century was the most important dominion of the white race west of the Atlantic. In the interval between 1520 and 1821, sixty-four Spanish viceroys, only one of whom was born in America, ruled in succession in the ancient capitol which Cortez had wrested from Montezuma. During this period three classes of people, quite distinct in character, appeared as subjects of the Mexican viceroyalty; Spaniards, Indians, and mixtures of the two. Such was the condition of Mexican society at the beginning of the nineteenth century, when the revolutionary movements in Europe gave rise to a revolution in Mexico, headed by Miguel Hidalgo. Hidalgo, the son of a farmer, was born in 1753. He was educated and ordained for the church, serving as curate in several places. Hidalgo was intellectual; his opinions on all subjects were in advance of the period, and he was the first to conceive the idea of an independent Mexico, not a helpless dependency of deteriorating Spain. Under his leadership, (1810–1811), a movement for independence, the Grito de Dolores, was started, which was not to die. Hidalgo was eventually vanquished by the royalist forces, and with his lieutenants, Allende, Aldama, and Jiminez, was executed July 31, 1811. This ended the first period of the struggle for independence in Mexico. Hidalgo's struggle for independence was continued by José M. Morelos, who, until the age of 30, was a muleteer. He was then made a curate, and later, like Hidalgo, became a general without taint of personal ambition. He led the independent troops from victory to victory, to be defeated by the royalists and condemned to death in 1815. This closed the so-called second period of Mexican independence. If the revolutionary leaders who followed him have not always been true to the example of his unselfish devotion to the cause, the mass of the population has never wavered in devotion to his memory. After the death of Morelos, the independent troops were headed by General Yturbide, who was able but actuated by selfish motives, and in 1822 the Treaty of Cordova establishing the provisional independence of Mexico was concerted by him and O'Donoju, the sixty-fourth viceroy.

Such movements, however, do not fundamentally change the character of a people. The republican system which was established on the ruins of the viceroyalty was stormier even than the government which it replaced. For almost half a century after the revolution there was little progress toward the establishment of a permanent and orderly administration. In [illegible] the confederacy of states was changed into a consolidated republic, of which Santa Anna was [illegible] and successfully maintained its independence, and [illegible] admitted into the American union. A dispute concerning the Texas boundary brought on war with the United States, at the conclusion of which, Mexico ceded to the United States territory north of the Rio Grande. Santa Anna, who had led the Mexican forces in the decisive struggle, was [illegible] the able and patriotic Benito Juarez gained the presidency. He [illegible] reforms, including the separation of church and state. The church party took advantage of an international dispute to intrigue with the French, and Louis Napoleon sent an army of invasion. An assembly of notables declared for an hereditary empire, and [illegible] Austria was induced to accept the crown. The struggle with the forces under Juarez continued until the hands of the United States were freed by the conclusion of its own Civil War. When at this time President Lincoln's attention was called to the fact that the French had sent an army into Mexico under Maximillian, and he was asked what he meant to do about it under the Monroe Doctrine, he said that the situation reminded him of the story of the two deacons who had been bitter enemies for many years. One was taken very sick and his recovery was questionable. The congregation of the church was anxious that he should not die unreconciled, and finally brought the two together. They [illegible] forgave each other, but as the one was leaving the room, the sick man sat up suddenly and said: "Wait a minute. Of course, [illegible] get well this doesn't go." The United States got well from the Civil War, and disregard of the Monroe Doctrine [illegible] Lincoln ordered the French emperor that he must withdraw his troops, and sent an army corps to the frontier ready to [illegible] The Emperor yielded and ordered the French soldiers to return to France. Maximillian soon fell, and independence under President Juarez was restored. Juarez was succeeded in the presidency in 1876 by General Porfirio Diaz, a strong and [illegible] When the aged Diaz was deposed, in [illegible]

the era of peace and prosperity ended, and 10 years of turbulence have followed during which there have been nine presidents.

The people of Mexico today may be divided into three well-defined classes; first, the native Indians, comprising the majority of the population; second, the Spaniards born in Europe or in Mexico, the latter often called Creoles; and third, the mestizos, or half-breeds, crosses between the other classes and the Indians, in varying degrees.

Mexico, in theory, is a democratic and federal republic, with twenty-eight states, two territories, and a federal district. In divisions it is analogous to the United States. Each subordinate part manages its own local affairs and all are bound together according to the amended constitution of 1857. The president is chosen by electors of the people in general election. There is a congress of two bodies, the senate and the house of representatives. The dominant religion is Roman Catholic, but all other forms of faith are tolerated. The public schools are supported by the state, and the attendance law is well enforced. English is taught in all public schools. The scientific methods in education, like those in South America, are of French origin. As a matter of fact a trip through Mexico gives one much the same impression as a journey into Peru.

The Mayas, and those who lived before them, the Toltecs, had developed a wonderful civilization long before the Anglo-Saxons had emerged historically. Remnants of the Aztecs, who established themselves in Mexico during the thirteenth century, are still to be found in broken tribes of more than one hundred groups, with various dialects. The relic which gives the best testimony of the mental powers of the early people is their calendar, which was carved in 1512, and is now built into the cathedral in Mexico City. Evidences of remarkable prehistoric Indian civilization are now being found in explorations in southern Mexico and Guatemala.

POLITICAL

The Indians today have little, and desire little. With their thatched-roof wattle huts, a few pigs and chickens, a banana tree, and a cocoanut tree they are happy and contented.

The people of the upper class in Mexico, who comprise about 10 per cent of the population, are educated, prosperous, and, naturally, contented. There is not a more intelligent and courteous people in the world. They speak French as well as Spanish. Refinement is ingrained in them from their background of the culture of centuries.

The population intervening between the uneducated Indians and the cultured Mexicans, about 20 per cent, might be called the middle class, and the government of Mexico today is in the hands of the radical group of this class. The leaders of this class are anxious to divide the great estates, and when one thinks of the many estates that run from 1,000,000 to 6,000,000 acres of the most fertile soil, of the great mines, and of the petroleum and other minerals, one may in some degree appreciate this view point.

The upper class in Mexico hate the present government with an abiding hatred for attempting to break up the large estates. The many revolutions in Mexico have had their origin in the middle class. Unionized railroads and trades badly led are trying out theories which include those long popular among the radicals, who teach that destruction of the property of the rich adds to the wealth of the poor, and that leadership by the fourth-grade mind will bring on the millenium. However, the Indian has been the cannon fodder for these revolutions, and he is sick of his job. It is doubtful that another general revolution will develop, at least for some time. The armies have lived on the country, and the agricultural districts have been swept by the troops so often that there is little left to live on. Mexico, who should feed a great share of the world, is getting from the United States much of the corn and cattle with which to feed her people. All the thinking people of Mexico are turning their eyes to their neighbor to the north, hopefully but doubtfully, for they have not yet forgotten that Texas was once Mexican territory.

However, conditions in Mexico today are fairly settled. There has been in recent years a series of more or less bloody political revolutions, but in the firm hands of President Alvaro Obregon and General Plutarcho E. Calles, secretary of state and chief of the cabinet, peace is being brought about. After all, the history of Mexico has been only that of other countries. Riots are not wanting in our own country. Military protection is to be found on all railroad trains in Mexico; it is needed on ours.

MEDICINE AND SURGERY IN MEXICO

Owing to political unrest in Mexico developments in the science of medicine have been retarded, and the civic hospitals are consequently in poor condition. In spite of this, excellent work is done in them and is more notable on account of it. Under the administration of President Obregon, General Calles, secretary of state, has taken up the matter of improving the hospitals.

He is giving every possible support for the purchase of new equipment, and several new hospitals are now projected. Seventeen years ago, President Diaz constructed a very fine hospital of 800 beds in Mexico City, on the separated pavilion plan much like the Virchow Hospital in Berlin. The hospital covers a great deal of ground which is beautifully parked. The Military Hospital, with 600 beds, under the direction of Dr. Francisco Castillo Najera, is a very old structure in the oldest quarter of the city. This is to be replaced by a fine hospital in a beautiful suburb. The Military Hospital provides quarters for the sick wives and children of the soldiers as well as for the soldiers. The hospital staff is excellent, and the work is modern. Dr. Najera is an active, progressive man, and conducts the affairs of the hospital most intelligently. Spinal anæsthesia with cocaine is used very largely, and we were told that in over 5,000 cases there had been no direct mortality from it. We witnessed several operations under this anæsthesia, one especially clever, for abscess of the lung.

We had an opportunity to visit the private sanitoria of Dr. Ulises Valdes and of Dr. Gabriel M. Malda. The morning we visited Dr. Valdes he performed, among other operations, a subtotal hysterectomy for a large myoma, and I was much pleased to note with what great pains he saved both ovaries. He tied all knots by the one-forceps method, manipulating with the forceps as dextrously as though they were his fingers the short end of a catgut thread deep down in the pelvis. Dr. Malda performed a very skillful operation in which we were much interested, an amputation of the leg at the point of election just below the knee, after the method of Dr. Monteo de Oca, a distinguished Mexican surgeon of bygone days; this technique probably is unknown outside of Mexico. The amputation was made with mathematical accuracy and the muscles were divided in a manner to give excellent function at the knee for an artificial leg and foot or to permit the use of the peg leg of the natives. Dr. Malda has a number of clever methods for facilitating work, among others a slipnoose that he uses with catgut which allows very expeditious and accurate suturing of deep wounds. I had never seen it before.

One evening while in Mexico City we attended the meeting of the medical society of the city; about 50 doctors were in attendance. The chief paper of the evening was on a urologic subject, illustrated by lantern slides. An interesting paper on yellow fever also was presented. The Rockefeller Foundation, greatly interested in the subject of yellow fever, has worked in conjunction with the Mexican Government for eradication of the disease. The domestic mosquito (*stegomyia calopus*), which carries the disease, lives in clear quiet water, and is always to be found within three hundred feet of a dwelling place, in drinking pools, wells, cisterns, tubs, and so forth. In Mexico this mosquito is not often found [illegible] altitude of three thousand feet. Five per cent infestation of water is considered safe. Top minnows are [illegible] of the mosquitoes. At first the native Indians objected very strongly to having these fish living in their drinking water, but this point of view is being gradually corrected through education. Noguchi's serum has great value in the treatment of the disease, both as a prophylactic and a curative; it is almost certain cure if given within the first 3 days after the onset of the disease. We had the pleasure of meeting the president of the Yellow Fever Commission of Mexico who has occupied this position for more than 20 years. In Colima, Captain Parks [illegible] of his monthly examinations which included over 11,000 tests, with an incidence of infestation of less than 1 per cent. This was a surprisingly good record, and the town of Colima is accounted safe. Captain Parks is conducting experiments in breeding fish for destruction of those numerous forms of mosquito larvæ which, unlike the stegomyia, live in quiet but impure water. At the present time he is using thousands of minnows from the streams, but as they are unsuited to this type of life he is attempting to develop the gold fish or carp which for years have been accustomed to dark and stagnant water.

The medical schools in Mexico are connected with the hospitals, and to a great extent the students live in the hospitals. Most of the textbooks used in medical schools are in the French language, and the system of education as well as the method and technique employed in the hospitals and operating rooms is essentially French. Practically every physician speaks French as well as Spanish and most of them have studied in the universities and hospitals of France. We were especially interested in some beautiful slides of the transitional stages of carcinoma in tissues developing cancer, shown us by Professor Guiterrez, chief of the department of pathology of the Medical School of the University of Mexico.

In Guadalajara there is an active body of medical men, and we had the privilege of attending a meeting of the medical association of the

city. Dr. Barrios and Dr. Chauvas are among the leading surgeons in the city.

A visit to Mexico in the interest of medicine and surgery will be found most interesting and profitable. One should particularly study the tropical diseases, which more rapid methods of communication will gradually bring to our own people. The medical traveler is received with the greatest kindness by members of the profession, and is accorded every courtesy by officials of the government. Heretofore many, unfortunately most, Americans who have gone into Mexico have gone so for the purpose of commercial exploitation. They have been careless if not rude in their dealings with these sensitive people in whom courtesy is ingrained, and on returning to America they have given their impression, derived from experience with the lower classes. The friendliness and charming hospitality accorded to us in Mexico caused us to leave with regret. Twelve years ago, in company with Dr. A. J. Ochsner, as now, I visited Mexico, and I hope to go again in the near future. The relation of the United States with the Spanish American countries will in time, when the broader, more intellectual people of both countries know one another better, become one of enduring friendship. Members of the medical profession can do much to promote cordial relations, for science has no country and its adherents meet on common ground. The officers of the American College of Surgeons expect to extend the membership of the association into Mexico, and there is no doubt that it will do much to cement the growing fellowship and friendship between the people of Mexico and the United States.

LATIN AMERICAN SURGEONS

Report of Official Visit to Colombia, Venezuela, and Cuba for the American College of Surgeons by Edward I. Salisbury, M.D., Denver, Colorado

PART I

The Spanish Main

SOUTHWARD HO! To the Spanish Main and our Brethren o' the Coast! It smacks of a romance of the sea, of conquest and despoliation; but no, for we bow in humble submission to the conquering graces of three more of our American neighbors. To Colombia, Venezuela, and Cuba the College extends the hand of fellowship and a hearty welcome to its ranks.

The third year of our Pan-American work has found the College extending its activities to those countries bordering upon the Caribbean Sea, or, as it were, to those republics bounding the Spanish Main.

The history of the Main, with its tales of conquest, of adventures, of colonization, and of piracy is perhaps better known among the nations of the world than the interesting story that accompanies the march of civilization to India, Australia, or to our own northern continent. The very mention of the name recalls many a romantic tale and conjures up the dreams of our boyhood past, when the midnight taper burned low and the blood curdled in our veins as the harrowing details unfolded, disclosing the buried treasure or the doings of a Pizarro or a L'Olonois. An enchantment still reigns over those seas, coasts and islets, and a red-blooded man with a God-given imagination cannot sail the Main but that the comfortable ocean liner as by magic fades away, and he finds himself pacing the deck of a phantom ship.

Itinerary

January	18	Left New York on *SS. Santa Teresa.*
January	25	Arrived Colon, Panama.
January	26	Left Colon on *SS. Santa Marta.*
January	27	Cartagena, Colombia.
January	29	Arrived Puerto Colombia, proceeded to Barranquilla.
January	31	Lower Magdalena—River boat *SS Barranquilla* for La Dorada.
February	8	Arrived La Dorada, proceeded on rail around rapids to Beltrán.
February	8	Upper Magdalena—*SS. Mariscal Sucre* for Girardot.
February	9	Arrived Girardot.
February	10	Via Girardot Railway and Sabana Railway to Bogotá.
February	21	Bogotá to Girardot.
February	22	Girardot to Honda, [illegible] *Union.*
February	[illegible]	Arrived Honda, [illegible] motor car to La Dorada.
February	24	Lower river boat *SS. Juinin* to Barranquilla.
February	28	Barranquilla.
March	3	Barranquilla to Puerto Colombia by rail.
March	4	Left Puerto Colombia for *SS. Venezuela.*
March	6–7	Curaçao, Dutch West Indies.
March	8	Puerto Cabello, Venezuela.
March	9	La Guayra, proceeded by rail to Caracas, Venezuela.
March	17	Left La Guayra on *SS. Asian.*
March	18	Puerto Cabello, Venezuela.
March	19	Curaçao, Dutch West Indies.
March	24	Cartagena, Colombia.
March	25	Colon, proceeded to Ancon, C. Z.
April	1	Left Colon on *SS. Toloa.*
April	2–3	Puerto Limon, Costa Rica.
April	6	Havana, Cuba.
April	13	Left Havana on *SS. Calamares.*
April	17	Arrived New York.

The Voyage

The *Santa Teresa*, a commodious and well appointed steamer of the Grace Line, carried me from the turmoil of our metropolis on a murky and cold afternoon during the month of January. Farewell to Miss Liberty became a how-do-you-do to Mister Freedom. Freedom of the seas is really a wonderful thing—if not a bulwark, it gives at least a stimulus to the North American constitution. Night fell with a biting wind howling through our shadowy masts with their derricks and ropes. By bed-time a look from the starboard rail told us that our good ship had left Barnegat and the lights of the Jersey shore far behind.

On the morrow a clearing sky and a balmy softness of the air greeted us. Our nearness to the Gulf Stream was already noticeable by the moderation in the weather. This sudden change was sufficient—the spell was upon us, and lo! we no longer steamed in a modern ship with the Stars and Stripes floating above us, but sailed straight away upon a goodly *bergantin*, flaunting [illegible] mizzentop the gold and red emblem of Spain.

Starboard the helm, and we're off for the Windward [illegible]

"Swiftly through the foaming sea
Shoots our vessel gallantly
Still approaching as she flies
Warmer suns and brighter skies."

And so we stood out to sea with well-filled canvas while the ropes creaked under the strain and the sailors fell to their chanties.

[illegible] upon the cry of land went up and there on the port was Watling Island, or San Salvador. It recalled the daybreak of October 12, 1492, when the weary watch first called out: "Land! Land!" In the mists hovering over the isle were three phantom ships riding peacefully at anchor in the cove, while ashore knelt a little band, and across the waters their voices arose, chanting hymns of thanks to their Maker for the new-found land.

Soon we were in the quiet waters of the Windward passage, and our course laid, to avoid Tortuga, near Cape Haitien—Tortuga, that rendezvous for the wolves of the sea—to where an Esquemeling led his zee rovers, a L'Olonois his corsairs, and a Morgan his buccaneers. Suddenly from behind a cloud-bank the clumsy galleon of a Portingale loomed up, her pennons waving in the breeze. In hot pursuit followed a brig flying the black flag of death. The pursuer gained a pace and came alongside its prize. They scuttled the brig that they might fight the harder, and boarded. In the sulphurous air was heard the crack of harquebus and pistol, while cries went up with every cut and thrust of the blade. A plank was pushed out over the high poop deck, and one by one, to the goad of a boat hook, the defeated went to their death. Some few met their end aloft and were left to dangle from a yard-arm, an example to all comers.

What matter it if in a dream we lose a few hundred years and give a passing thought to those heroic deeds, now brilliant pages in the history of our war with Spain?

The Caribbean Sea

On the starboard is Cape Maysi, the eastern tip of Cuba, and a few miles up the southern shore are Santiago and Guantánamo. In the blue waters of the Caribbean that wash these strands lies the the fleet of Admiral Cervera, who bravely went out to meet us July 4, 1898, knowing defeat certain.

As Spain's power on the seas was born in the West Indies, so it perished in the place of its birth.

There is perhaps no place in the seven seas more loved or more feared by the mariner than the Caribbean. This beautiful turquoise of the Atlantic, reflecting the deep blue of a tropical sky, can become on occasion a veritable inferno, when contrary winds lash its currents into foam-laced mountains and toss sturdy vessels about like toys. Truly the early adventurers must have felt that El Dorado was nigh when they sailed into that sea in calm seasons, and on contrary days that the old superstition, that the hand of the devil would reach out of the unknown sea and snatch them to death, would come to pass.

Columbus named the coast bordering this sea, from a region about Santa Marta in Colombia to Cape Gracias á Dios in Central America, Castillo de Oro (Castle of Gold) and Costa Rica (Rich Coast). Castillo de Oro included that part of Tierra Firma (as the whole was named) now known as Colombia and Panama.

Columbus sailed into every nook and cranny of that coast in his voyages to the New World. He named Navy Bay, where Colon is now located, Nombre de Dios (Name of God), and Puerto Bello (Beautiful Port).

Puerto Bello and Cartagena were strongly fortified by the early Spaniards, for it was here that the *bergantins* and caravels and the great caracks laden with treasure gathered and awaited a place in the convoy of galleons or men-of-war to escort them to the mother country.

Colombia

Cartagena

Cartagena was the largest, and is today the most interesting city, of the coast. Protected seaward by a coral reef and landward by the fortress of San Felipe and the forts of the beautiful harbor, it still could depend in battle upon the enormous walls that enclosed it on every side.

The harbor is often compared to that of Naples. La Popa, with its ancient convent surmounting it, forms the background, towering over the city. There are two entrances, Boca Chica (little mouth) and Boca Grande (great mouth)—the latter being closed by the Spanish to save fortifying it. As a ship passes through Boca Chica, it is met on every side in its approach to the city by projecting forts that stood guard in more turbulent times, when Drake, Raleigh, Hawkins, Vernon, and Pointis attempted to storm this stronghold.

It was one of the greatest pleasures of the trip to wander through the land gates of this old city and walk its narrow streets and the broad tops of its bastions, to explore its tunnels and dungeons,

the while ruminating on the past. Here were the embrasures for the great cannon, there the slots where the chains passed to lower the drawbridge across the moat to the outer enclosures; a ring here for securing the portcullis that barred the entrance to a tunnel of escape, and another there with its fetters for a prisoner.

The old house of the inquisition still contains mute evidence of an intolerant day, when the Spanish mind, warped by the cruelty of the Moor, had turned to retaliate by forcing its religion upon others. There are the rack, wheel, tongs and dungeon, just as they were the day the Mother Church put an end to the intolerance of the Spaniard. Strange that Spain should carry her troubles, coming out of the Moor invasion, to a new land; but our Puritan did the same.

I found an old history of Cartagena in one of its bookshops. It is replete with old legends and traditions of the place. It contains stories of conquest and war, of the bravery of an adventurer and the cruelty of a pirate, with quaint references to their life and oft their death. Then too there are tales of love, even to the wooing of the Governor's daughter by a daring corsair. The book is worthy of translation.

Of medical lore I might mention one little story connected with the founder of Cartagena de Indias (Cartagena of the Indies), as it was called in contradistinction to Cartagena in Spain.

Cartagena was founded in 1533 by Don Pedro de Heredia. The locality had previously been visited by Bastidas, the founder of Panama, by Vespucci, and by others, but the strong resistance of the Indians prevented them from establishing a colony.

Heredia, as tradition states, was more fortunate than the rest, as he inherited from his forebears the inclination to adventure and to boldness, so that by his constancy in winning daily battles with the Indians, he vanquished them. Referring to the chronicles of his early life, to show his spirit—upon a certain night, while out bent on a gallant adventure in the narrow and divided lanes on the outskirts of his native village, he was attacked by six gentlemen. These gentlemen so badly impaired Heredia in the affray, even to the losing of his nose, so states the story, that afterward it was restored by surgeons who newly formed it through the medium of rhinoplasty, using the fleshy part of one of his arms. The story continues and says that now cured, but finding his once comely nose deformed and of bad color, Heredia, burning with wrath, sought out his aggressors, challenged them in unequal combat, and killed three of them. This I recite as an example of the p[illegible] in [illegible] 15[illegible]

Cartagena is a city of perhaps over thirty thousand without a water supply except the gentle rain, which for some reason is not abundant in that small tropical area. Water was selling at the rate of thirty cents for a five-gallon gasoline can filled sparingly with the precious liquid. A prominent Engli[illegible] told me that frequently her Sunday morning general ablution was provided by the drippings from the icebox. Water is brought from a great distance in kegs lashed to the backs of burros. Many of the lower classes obtain a species of the liquid, neither sweet nor altogether brackish, by digging holes along the beach and dipping up the water thus filtered drop by drop.

This city is one of the principal *entrepôts* of the country and is connected to the Magdalena River by a short line of railway.

Other Colombian Ports

The other great port is Puerto Colombia near the mouth of the Magdalena, but it too is separated from the river port, Barranquilla, by a railroad.

Sabanilla was the ancient port to the river and sea, but time made a sand-bar that necessitated its removal to deeper water. At present all that remains is the old Spanish Custom House, a landmark for the mariner (to avoid), for most maps mark the port as Sabanilla, and in recent months a schooner from Germany laden with cement and dynamite found herself high and dry on the shoals while steering for this old port.

The Magdalena River

The capital of Colombia is Bogotá, and is situated on a high plateau just over the eastern range of the Andes. The principal approach to the capital is by the Magdalena River, which flows in a valley formed by the eastern and central ranges of the Andes. If memory of geography serves me rightly, the Magdalena ranks fourth among the rivers of South America—the order being Amazon, Orinoco, Paraná and Magdalena. Ocean-going vessels cannot enter the river, or La Boca de Ceniza as it is called, because of a bar of silt that has collected. However, Colombia has in the past few months passed a bill authorizing the dredging of the mouth and river to Barranquilla. This will be a great advantage in the handling of shipping, as it can be transferred directly to and from ocean vessels and river steamers.

The trip up the Magdalena can hardly be equaled even by a sojourn on the Nile. With favorable conditions, viz., plenty of water in the river, and aboard an express boat, one should reach Bogotá in seven or eight days. The journey from Barranquilla to Bogotá is about nine hundred miles and necessitates several changes. The express boats carry the mail and are convenient in that all carriers make connection with passengers and mail. The first leg of the trip is on the *rio bajo* (lower river) to La Dorada, then comes a rail trip around the rapids to Beltrán, where a smaller boat carries one up the *rio alto* (upper river) to Girardot at the head of navigation. The night is spent at this river port and the trip continued by rail to Bogotá, a full day's travel over the Eastern Cordillera.

The river boats are similar to the old Mississippi river boats with stern paddle-wheels. They have metal rounded bottoms and draw three to four feet of water. There are usually three decks, the lower one reserved for the boilers, which are placed forward with a supply of wood, which is the usual fuel; midship the freight is stowed, and aft are found the engines, kitchen, and two or three pens for cattle, pigs, and chickens in lieu of a refrigerating plant. Slaughtering goes on daily on this part of the deck, as the supply of available meat is consumed. The staterooms are furnished with a canvas cot, wash basin and pitcher, and an electric fan. The passenger supplies his own linen and towels. The water supply to the rooms is direct from the muddy water of the river. The drinking supply is filtered through a stone jar, and this is hardly safe for the stranger. A limited supply of carbonated water is sold at the bar, or the traveler may bring a case or two aboard.

I left Barranquilla Tuesday evening, January 31, on the river express boat. Our boat experienced considerable difficulty in forcing itself from the quiet channel into the turbulent waters of the lower river, where they rush out of the wide delta to meet the ocean. Once out upon its broad expanse we turned our prow toward the Southern Cross and began our ascent of the Magdalena.

The bed of the river is quite tortuous, and the channels for the boats change from day to day as the silt and sand are carried away from one part and deposited in another. We were one full week upon the lower river, but every mile traveled was a revelation. The first few days carried us past mangrove swamps and marsh lands covered with impenetrable thickets and wild plantain and banana. As we ascended further, the banks took definite form and the terrain spread out into wide *savannas* that stretched forth to meet the foothills in the far distance. Here and there were native thatched huts with adjoining garden spots safely enclosed and protected from the domestic animals by close wattled fences. Scattered out upon the plains and at the river's brim were small herds of cattle. Now and then we passed or stopped at native villages where the populace came down to meet the express—a weekly event among the attractions of the town. Daily there were other stops at the wood supply stations, and at these times we sweltered from the intense heat and were greatly annoyed by the mosquitoes. Each night we suffered the same tortures because of low water, navigation was dangerous, and we tied up the boat at the first convenient tree ashore as dusk came on. Daybreak would find us continuing the journey in midstream where a refreshing breeze made living more bearable.

There are always many natives of the better class traveling and they are delightful companions. They have many local stories to tell of their country and keep one entertained. Some will try their knowledge of English with you, and you always feel that perhaps they are just a pace ahead of you and use better English than you do Spanish. In the evening the *tiples* and guitars are brought out, and all indulge in their folk songs and *arias* from the popular operas. The younger generation spend the early evening in games resembling very much those in vogue in our own country. I tried out my Spanish by playing with them, much to their delight when I was caught napping and made "it." I was thus forced to make up a sing-song rhyme to suit that stage of the game, and apparently it had the desired effect.

Each day brought new sights and wonders. After two or three days we were impressed by the wealth of bird life. Continually we saw great flocks of ducks, parrots, paraquets, and *garzas*. The *garza* is the heron or egret bird, and there are several distinct varieties—the black, white, grey, and even the rose-colored heron. At times there would be hundreds of these birds standing in the shallow water over a sand-bar. Whenever our boat passed close to a wooded bank, there was opportunity to see many strange and beautiful birds in the trees. Occasionally, but rarely, there were monkeys, chattering and climbing from tree to tree. At one time a few of us saw a snake spring from the bank and strike a bird wading at the water's edge—it happened in the twinkling of an eye, and the reptile captured its prey. The chief attraction of the Magdalena is the huge alligator or crocodile that infests its waters. The question of the species is the source of continual

argument among the travelers of this river, and the point of their man-eating or non man-eating tendency is thrashed out daily. Be that as it may, I saw evidence of two deaths from either crocodile or alligator—the first, one of our boatmen who fell overboard, and the other a boy or young man who was found the next day in one of the ports his head only was recovered. The largest of these animals or reptiles appears to be twenty-five to thirty feet long and possibly three or four feet across the back. They appear in enormous numbers—in one small group I counted thirty-six.

Barranca Bermeja

The end of the first week brought us to Barranca Bermeja (Vermilion Bank), where the central depot of the Tropical Oil Company is located. The oil fields of this company are some miles back in the jungle along the Rio Colorado, but the storage tanks, the offices, dwellings, and hospital are situated at this point on the Magdalena. The river bank here is very high, and the earth is a red clay—hence the name of the town—Vermilion Bank. The tributary river whose waters are colored by this clay is named Rio Colorado, or Red River.

The sixth day of February was spent on a sand-bank, from which we finally released ourselves by carrying the end of the cable ashore and making it fast to a tree while we wound up the other end on the capstan. After uprooting several trees, this process succeeded in drawing us into deeper water.

La Dorada—Upper Magdalena River

On February 8 we reached La Dorada, the end of the lower river travel. After transferring mail and baggage we were transported by a narrow-gauge railway around the rapids to Beltrán. This line of railway passes through a variety of country. For a short way to Honda it follows the river and then turns out at a sharp angle through the hills and rugged crags of a castle-like formation to the plains at the foot of the Central Cordillera. Here lies the town of Mariquita, a shipping point from the mines of the Cauca Valley beyond. The road turns abruptly back from Mariquita to the river at Beltrán. At this point we embarked on the upper river boat *Mariscal Sucre*. The crowd on this little boat exceeded many times the accommodations. There were hardly enough staterooms for the lady travelers, and the men all "parked" on and under tables and benches, and upon the few cots provided. A bribe of a *peso* to one of the deck boys permitted me to spend the night on deck on one of

City Wall, Cartagena, Colombia

the cots, with fifty others "camping" in the neighborhood. Everyone was stirring at daybreak, and one was well repaid for rising early. The boat was forging ahead through rapids with the lower deck awash. The river bed had become the floor of a rock-bound canyon, and the roar of the struggling engines echoed back from towering cliffs. This is the most picturesque part of the Magdalena. New verdure greeted us upon every side, and in the lifting haze dim forests of *balsa*, *ceiba*, and *caoba* were seen covering the adjacent mountains.

As we steamed along, the river had all the appearances of one newly discovered. Flanked alike by jutting rock and bamboo, the upper river is truly beautiful. Occasionally, far to the westward, we could catch a glimpse of Mt. Tolima with its snow-capped peaks, strange to contemplate when you consider that it is only four degrees from the equator. As the morning wore on we met many *balsas*, or rafts, and *champans* floating down-stream with great cargoes of pottery and produce for the native markets. Along the rocky flats near the villages the populace were out taking their daily bath—men, women and children alike—while just at the water's edge the family laundry was in full process. Further up-stream Indians were in evidence, but very few of them. The men were fishing with nets, and a few of the women were washing their garments on the stones. The raiment of the men was very limited. A very bright red semi-skirt about the waist was the only covering, excepting the straw hat with its brilliant red band. The Indians were quite adept in handling their *cayucos* or canoes in the swift-flowing stream, and it seemed to delight them to ride the waves caused by the passing of our boat.

Girardot to Bogotá

We arrived at Girardot at sundown and betook ourselves to Hotel San German, thankful to be

Bolivar Monument, Cartagena, Colombia

free from boat-cabins and mess-tables. The tropical hotel is a marvel. You pay for a bed rather than a room. I shared a room with traveling companions, a man and his wife from the United States. We had each a corner in a large *adobe* room, each cot screened apart from the rest of the space. Beds are not in use, as they are hot; so canvas is stretched tightly on a frame to provide a resting place. On the ranches a tanned cowhide cot is quite the thing. All are furnished with mosquito nets.

In the morning our *equipajero* called us in order to be off for Bogotá. An *equipajero* is a sort of courier who travels up and down the river and cares for your baggage in its many transfers. He is indispensable, and one of these men can care for a number of passengers. He hires porters at every change and guards your belongings. The transportation companies do not have a baggage department to care for your trunks. This is left to the *equ pajero* who is usually quite loyal to his customers.

Our train left at eight o'clock for the climb over the mountain. It is a slow and dusty trip until midday. By that time the fields of banana and sugar cane have been left far below and we

River Boat of Lower Magdalena

stop for lunch in a more temperate clime. The profusion of fruits at La Mesa is marvelous. This mountain stop has the advantage of receiving in its market the fruits of the tropic and temperate zones—grapes, apples, peaches, strawberries, melons, as well as oranges, bananas, mangoes, *nisperos*, *mameys*, *anonas*, and the hundred and one other delicately flavored fruits of the tropics. At Esperanza, the next stop, one experiences a delightful change in the atmosphere and vegetation. It becomes pleasantly cool, while all about are beautiful palms and shading trees. Flowers are blooming in profusion. Bougainvillæa, hibiscus, acacia and royal Poinciana are everywhere. Here many of the travelers stop to become accustomed to the change before proceeding to Bogotá, which is eighty-six hundred feet above sea level. The journey from here is very interesting. Farms with corn and wheat, and plantations of coffee and cacao spread out in one beautiful vista. The air becomes cool and clear, and, when at last we reach the tunnel, everyone prepares for a quick change from linen or palm beach to wool, or seeks his overcoat. The minute spent in the tunnel changes everything from clothes to temperature. Once on the farther side, the chilly

Capitol Building, Bogotá

blast of the *páramo* makes the stranger wish for furs, and the native muffles to his forehead over his mouth and nose that he may not contract pneumonia.

We were soon over the summit of the range, which is much higher than Bogotá, and began to glide down to the great plateau of Funza, where the capital is located. We changed trains at Facatativá, as the roads are of a different gauge—the Girardot Railway being a yard gauge and the Sabana a meter. It is only in recent years that the Girardot line was built, as previous to that time the old mule trail was used to Honda, where freight was transported to the river boats. The Sabana Railroad has been in existence for many years; in fact it was one of the first built in Colombia. When it was decided that progress in transportation meant the building of railroads, the capital was, of course, the first city that should have one. Rails, engines and equipment were dragged up the trails over the mountains to the plains, and construction proceeded from the center of the country instead of building it from its sea and river ports.

Plateau of Funza

The great plateau of Funza is most impressive to view. After the long and hot tropical trip one feels as if he were in a fairy land. As far as the eye can see are rolling plains and verdant *sábanas* reaching out to the faint rim of mountains that enclose them. Fields green with growing wheat, millet, and barley, beautiful herds of Holstein and other cattle grazing in pastures where meandering brooks flow, make a picture of industry and contentment. To add beauty and quaintness to the scene are the little white, pink, and blue ranch houses with tile roofs, and a surrounding wall and stately gate, all of which have a tile coping. The large main gate to house

"Spotless Town" and Pontoon Bridge, Willemstad, Curaçao, Dutch West Indies

are edged by rows of majestic eucalyptus trees, giving a most attractive effect. The eucalyptus tree is not indigenous, but was imported many years ago from Australia.

The native population, that is the gentry, of the mountainous and plateau region is mostly Indian. They are a simple folk and have a rather comely appearance, with rounded faces of an olive hue and rosy cheeks; faces of beings upon whom the strain of life it seems has never fallen. They go about with their wool *ruana* over their shoulders, a quite contented lot. Seldom they travel, and very few of them have ever visited the falls of Tequendama, where this cataract tumbles six hundred feet (three times the distance of Niagara) from the very edge of their landscape to join the head waters of the Orinoco. It can truly be called one of the wonders of the world, yet to these people its existence is mere legend. These folk are the descendants of the old Chibcha nation that was conquered by the Spanish, as were their counterpart in Peru, the Incas. The history of the discovery of this plateau and its people is extremely interesting. Almost simultaneously there arrived in these regions three expeditions, one each from the North, South, and East. The incident occurred in 1538 when Gonzalo Jiménez de Quesada appeared with one hundred infantry and sixty cavalry. He had set out two years previously from Santa Marta by land, and the Magdalena, with eight hundred men and one hundred horses. Presently Nicolas Federmann loomed up with one hundred half-starved men. He represented a German exploitation company, the Welsers, a banking firm, and had traveled up the Orinoco and Meta rivers, having started on his long search five years before with four hundred well-armed and provisioned men. Following his arrival came Sebastian de Belalcazar, an associate of Pizarro in Peru. He left Quito after the conquering of the Incas, and was in search of another civilization said to live far to the North. Quesada evidently played the part of a diplomat and organized all the forces against the Chibchas, a nation said to have numbered a million souls. Having accomplished his end, he settled peaceably with the other *conquistadors*. To him is credited the founding of Bogotá, or Santa Fe as it was named and declared a city by Charles V in 1540. Bacatá was the name of the old Indian capital, and thus today has developed the name Bogotá or Santa Fe de Bogotá.

Bogotá

It was dusk when our train reached Bogotá. On our approach we could see the twinkling lights of the city nestled at the foot of the mountains Guadeloupe and Monserrat. The station is a modern one, with train sheds and gates—quite fitting for the capital. All was bustle and hustle in the streets, with coaches, autos, and tram cars in profusion. I was whisked off to my hotel (one that I had been a guest in several years before), and I began preparations for an enjoyable week of work and association with the medical faculty of Bogotá.

The city has about 160,000 inhabitants, a great many more than industry can care for; hence there is a great percentage of pauperism. The climate is delightfully cool and pleasant during the day, but it is rather uncomfortable indoors at night, as no provision is made for heating the houses. Bogotá is noted for its beautiful buildings and churches, the cathedral being a magnificent example of the Roman type of architecture of the Spanish Renaissance. The residential district of Chapinero contains many beautiful chalets and villas, homes of the well-to-do, although not a few still retain their typical Spanish homes in the heart of the city. There are many pretty drives about the city, one in particular, Paseo Bolivar, which is located on Mts. Guadeloupe and Monserrat, and permits of a wonderful view of the city. Upon one of these peaks there is a chapel to which many people make pilgrimages. I experienced one day almost the sense of seeing an apparition. I was out for a walk. Heavy white clouds had obscured the mountains so that the sky alone appeared in their place. Suddenly the sun came out, illuminating the fleecy cloud-banks on the mountains, and there suspended in mid-air was the little white chapel, a perfect miniature upon porcelain. The

effect was startling, but lasted only a moment when it was spoiled by shifting clouds.

Bogotá held the court of the Viceroys in the pre-republic days. It was the center of the Spanish government in South America. In the Palace of San Carlos were read the declarations of the king which were law and life to the New World subjects. In this same building I met the Secretary of External Relations, Señor Dr. Antonio José Uribe. I was introduced by my friend, Dr. Carlos Adolfo Urueta, former minister from Colombia to Washington. Both of these men were influential in the Colombian ratification of our recent treaty with that country which was exchanged during my stay in Colombia.

I spent a full week visiting the hospitals, clinics and institutions of the city, a report of which is appended to this article together with an announcement of the committee nominated to act for Colombia.

Bogotá to Barranquilla

I rather dreaded the return trip down the river. After finishing my business, it was too late to catch the express boat, so I determined to try my luck in catching intermediate boats. It worked very well. The first day was spent going down the mountain to Girardot, where as usual one must remain overnight. I was fortunate in obtaining accommodations on the upper river steamer *Union* which left Girardot the afternoon after our arrival. This boat carried us to Arrancaplumas, the port for Honda, and several miles below Beltrán, where we had embarked on our upstream trip. Honda was reached the next afternoon, where I learned that a boat would leave La Dorada the following morning. It was out of the question to go by train that night, and the morning train left too late; so, after meeting the general manager of the railroad and explaining to him my desire to catch the boat, he placed at my disposal a motor bus on car-wheels which landed me safely in La Dorada by sundown. The *Juinin* left port early the next morning and arrived in Barranquilla four days later, on February 28.

Colombia to Venezuela

Departure

It was necessary to delay a few days in Barranquilla until March 4, when I boarded the S.S. *Venezuela* of the Dutch West Indian Mail Line for La Guayra, the port for Caracas. The voyage would have been an enjoyable one for me had I not been suffering from dengue, or break-bone fever, which I probably contracted along the lower Magdalena and continued to have until after reaching Caracas.

Curaçao, Dutch West Indies

Two days were spent in Willemstad, Curaçao, Dutch West Indies, and one day in Puerto Cabello, the port for Valencia, Venezuela, before we reached La Guayra on March 9.

Willemstad is a very pretty little port with an inland harbor. The town lies on both sides of the inlet and is connected by a pontoon bridge. This bridge is operated as a private enterprise and a toll of two cents for crossing is charged to persons wearing shoes, while only one cent is levied upon the barefooted or those who wish to remove their shoes and carry them. When a steamer is entering or leaving the harbor, the bridge is swung back by a cable that is wound upon a steam windlass. The inhabitants are a mixture of Dutch and Spanish, and so is their language. Curaçao is a colony governed by the Dutch and enjoys a free port. I was able to supply my wants in American made goods at prices several cents cheaper than at home.

Venezuela

Puerto Cabello

Puerto Cabello is a rather busy little port and has a small shipyard. In the plaza near the wharf is a rather dignified monument erected to the officers and soldiers of the United States who aided the Bolivian States in the war of separation from Spain. It bears the shields of Venezuela and the United States, and the whole is surmounted by a golden spread eagle.

Caracas

Caracas can be reached by train or automobile from La Guayra, a distance of about twenty-three miles. It is located on a plateau just over the coast range, and, having an altitude of three thousand feet, it enjoys in the tropic belt a temperate climate. The region about Caracas in the pre-Spanish days was inhabited by Indians. Within ten or twelve leagues of this plain, it is said, were 150,000 Indians, with more than thirty *caciques*, or chiefs. These were conquered by Don Diego de Losada, and the city founded by him in 1567. Today it numbers 100,000 inhabitants, and architecturally is a beautiful city.

Its many public buildings are adorned by wonderful paintings by noted Venezuelan artists. I was guided to the places of historic interest by Señor Manuel Segundo Sanchez, a banker by

profession, but the foremost historian of Venezuela. Señor Sanchez possesses a delightful personality and a brilliant mind. He is a true lover of his native land, and was one of the representatives of his country at the presentation and unveiling of the equestrian statue of Bolivar in Central Park, New York City, in April, 1921. With him I visited the birthplace of the great Bolivar, which is being restored by the nation. Señor Tito Salas, to whom I was presented by Señor Sanchez in Bolivar's old home, is depicting on canvas the life of the great liberator and general. At the time of my visit, Salas was painting the founder of Caracas, Don Diego de Losada, in the full uniform and helmet of the *conquistador*. The artist was using the face of my distinguished friend, Señor Sanchez, as a model for this painting. In the Pantheon are the remains of Bolivar, returned to his native city from Santa Marta, Colombia, the place of his death. Over the tomb is a beautiful monument of marble, with a standing figure of Bolivar—the whole the work of the sculptor Tenerani. The Pantheon immortalizes many other patriots and statesmen and cherishes tombs or tablets to their honor.

I spent eight interesting days in Caracas, visiting its buildings, viewing its art, and in happy contact with many of its citizens, outstanding among them the members of our profession.

To Panama—Canal Zone

I left Caracas on March 17, boarding the *S.S. Asian* of the Leyland Line at La Guayra that night for Colon, where I arrived on March 25. The *Asian*, in charge of her very able and friendly master, Captain Thomas, stopped at the usual way ports, affording time to visit again those interesting places, Curaçao and Cartagena.

I was delayed in the Canal Zone a full week before obtaining reservations on a steamer to Havana. I was glad of the opportunity, and spent the time with my old associates of the staff of Ancon Hospital, where I had served for three and a half years. I met Dr. Francis P. Corrigan, of Cleveland, who was just returning from a mission for the College to the republics below the equator. He was much elated over his reception by the Fellows in South America, and by their sincere interest in the American College of Surgeons.

Costa Rica—Puerto Limon

The Havana boat stopped for two days at Puerto Limon, Costa Rica, where I met Dr. Facio, Superintendent of the United Fruit Company Hospital, and his two assistants, Dr. Montealegre and Dr. Jiménez, all very able men from North American schools and hospitals.

Cuba—Havana

I arrived in Havana on the *Toloa* on April 6, and spent a week in that wonderful city. I need not describe Havana, as the port is quite familiar at least in story to nearly everyone. The harbor where our *Maine* lay buried for so many years is a very busy one, and the docks and wharves are all of modern construction. The city is a mixture of the old and the new, churches and edifices of Spanish design beside modern steel and concrete buildings. The boulevards and drives and the new residential suburb, Marianao, are beautiful. There are historical places to visit where one can speculate on the past, or there is the Casino, the race track, and the *jai alai* games where one can gamble on the future. Havana has several clubs, but the Country Club possesses the prize golf course, where royal palm trees constitute hazards, along with two brooks and a sizeable river. I thoroughly enjoyed eighteen holes on this course with Dr. Carlos E. Finlay of Havana and his brother, Mr. George Finlay, who had returned to his native heath from New York for his winter vacation. I was reluctant to leave Havana. It seemed like a wonderful playground, and North Americans have joined the Cubans in making it such. Havana is not the haven for the thirsty that many people judge it to be. There is no Volstead Law, of course, but I did not see one instance of the abuse of the use of liquor.

Homeward Bound

The *Calamares* of the Fruit Line was my homebound ship. It left Havana on the evening of April 13, and, after affording us a happy Easter aboard and a delightful voyage, landed us safely in New York on April 17.

PART II

COLOMBIA

The Welcome

I WAS welcomed at the American Legation in Bogotá by Mr. Hoffman Philip, our minister to Colombia, a very able representative of our State Department. Mr. Philip, though trained and expert in our diplomacy with the Near East, has well filled his post in Latin America, and has shown his great ability by the part he has taken in the negotiation of our treaty of friendship with Colombia. He sensed the feeling of Colombia against the United States in regard to the Panama difficulty, and has greatly aided the restoration of our former friendly and mutual relations.

Mr. Philip very graciously arranged a meeting for me with Hon. Dr. Carlos A. Urueta, the Colombian minister to Washington, who was home on a leave of absence. Dr. Urueta introduced me to Dr. Luiz Filipo Calderón, rector of the Faculty of Medicine, to whom I stated my mission. The rector, not being a surgeon, appointed Dr. José M. Montoya to call a meeting for me.

Committee on Credentials

At a meeting on February 16, Dr. Pompilio Martinez, the dean of the surgeons of Bogotá, was nominated as chairman of our credentials committee, together with the following members:

José M. Montoya, orthopedist, Bogotá, Secretary;

Rafael Ucros, gynecologist, Bogotá;

Juan B. Montoya y Flores, general surgeon, Medellin (representing Central Colombia);

Rafael Calvo, C., otologist, Cartagena (representing the Coast).

On the evening of February 19 a general meeting and dinner at the Gun Club was arranged by the committee. The rector of the Faculty presided, and, after an elaborate banquet, he gave a toast to the College for the interest shown in coming to Colombia on such a friendly mission. I responded to the profession in Colombia, and to the future of their hospitals which I judged from the signs of progress in hospital work among them. A discussion of the American College of Surgeons followed, which brought forth enthusiastic utterances as to hospital progress in case they become a part of the College.

Bogotá — Medical Center

Bogotá has always been a medical center in the New World and today contains the principal school of medicine in the country, a branch of the national university, known as the Faculty of Medicine and Natural Sciences.

The early history of the medical profession in the New World is somewhat obscure; however, some data are available in the old chronicles. The name of Garcia Fernandez is mentioned as the physician who accompanied Columbus on his first voyage to America. Many years after, in 1579, there came to Bogotá to practice medicine the Licentiate Don Alvaro de Auñón, the first *Médico Diplomado* whose name is recorded. In 1639, Dr. Diego Henriquez came from Spain with the title of *Protomédico*, whose commission was to teach medicine and grant licenses for its practice. The College of Rosario, still existent, was founded in 1640. A chair of medicine was established in this college in 1758 when, after the death of Henriquez, the Viceroy appointed Roman Gancino as *Protomédico*. This school received a royal charter in 1801, and continued to teach until the founding of the Republic, when Congress established the national university with its department of medicine. The school of medicine is well housed in new buildings, some of which are still in course of construction. Its laboratories of anatomy, pathology, bacteriology, and chemistry are up to the minute in every way, a credit to any school. It lacks a practical course in physiology and has no such laboratory. The curriculum is planned for six years, and clinical work is given in the last four years.

Hospitals

The principal hospitals of Bogotá are the San Juan de Dios, Misericordia, and Marley. The first named is the great charity hospital. It is located in the heart of the city and though it is intended for about three hundred patients, it houses twice the number. This congestion and crowding is marked to the observer. The hospital is in the charge of Sisters whose number is somewhat limited, just enough for supervision; hence the nursing system is inadequate.

The Misericordia is the children's hospital and has a capacity of one hundred and twenty beds. Its daily census runs about seventy-five. Here the proportion of Sisters to patients is higher, and more attention is given to nursing.

Marley is a private hospital, but Sisters are paid to supervise it. There are several clinics, or *casas de salud* owned by individual doctors, some in the care of Sisters, and others under women trained for the work. I visited two or

Hospital San José, Bogotá, Colombia

New Hospital Cartagena, Cartagena, Colombia

these, one under the jurisdiction of Dr. Pompilio Martinez, and the other of Dr. Manuel V. Peña. Both were adequately furnished and modern in every respect. All of the hospital operating rooms are well equipped, and aseptic technique is fully carried out. Another feature that would please our Hospital Standardization Committee is the complete hospital record system. Complete histories and progress records are kept of all patients. I watched several of the prominent surgeons operate, some difficult cases too, and all showed fine surgical skill and judgment. I attended the dedication of the new San Juan de Dios hospital in La Hortua, a suburb. It is built on the isolated pavilion plan, and will probably accommodate twelve hundred patients when completed. The buildings were originally intended for an insane asylum, but a new site was obtained in the country and the plans were changed to build them as hospital units.

The surgical society of Bogotá has been constructing a new hospital also, to be known as Hospital San José. It has been under construction for about twelve years, work being carried on as funds are available. This is a beautiful group of buildings, with large and well ventilated wards and private rooms. The operating rooms or amphitheaters are well equipped with modern apparatus, as are all the wards and departments of the institution. Nothing is wanting except a staff of doctors and nurses to step in and receive the patients.

The Nursing Problem

The nursing problem is as perplexing in Colombia as in many of the South American republics. Speaking broadly, there are no nurses, and several reasons exist for their absence. In the first place, hospitals have been charitable institutions conducted by religious orders, where the halt, the sick, and the aged have been given shelter and food and what medical care it fell within the skill of the individuals in charge to administer. No one entered save the poor. The better classes called a physician to their homes, where their friends and relatives gathered, stood watch over the sick one, and cared for him. It was a work of love and not a business. Nuns gave their life to it as God's work, not as hirelings.

Another phase developed from an increase in the number of inmates in these hospitals with a corresponding decrease in the proportion of nuns to care for them. To aid them, the poor were hired to work in the wards; so nursing became menial labor. In consequence of these two conditions, nursing has not become the profession of merit and the real science as we know it in this country.

A third point held by some is a moral one. It is not considered conducive to good morals for young women to study along medical lines and then go forth to care for strangers. The young women necessary for such work, who are educated and come from good homes, are not free to enter the nursing profession. In fact women do not participate in the affairs of public life.

One of two things will be necessary to place nursing on the basis of a merited profession, and either will bring about the other as well. The people will become educated (as we say in the States) to the advantages or necessity of hospitalization of all patients, whether rich or poor, in which case the better class will demand nursing; or the public will sense its duty to the sick and develop nursing as a profession, which in turn will elevate the standard of the hospitals, and all patients will seek the protection and advantages of the hospital.

The medical profession of South America realizes the need for nurses; but it is difficult to bring about the necessary change in the mind of the public to encourage training schools.

Experimental Laboratory

Dr. Bernardo Samper and Dr. Jorge Martinez conduct a private laboratory in the city which is equipped to do all routine [illegible] biologic products. They manufacture vaccines, anti-diphtheritic and anti-tetanic sera, and conduct experiments in the prophylaxis of animal diseases. A North American veterinary is attached to the laboratory, and quite elaborate studies are made of anthrax, piroplasmosis, trypanosomiasis, and other stock infections.

Typhoid is endemic in Bogotá, and several years ago, at the time of my first visit, Dr. Samper and Dr. Martinez were introducing typhoid vaccination among the students, firemen, policemen, and soldiers who were stationed there. I felt that it would be a real test of the efficacy of vaccine, as no particular anti-typhoid sanitary measures were carried out. Accordingly, I was anxious to peruse the statistics of the experiment. Dr. Martinez informed me that [illegible] of ten thousand who were vaccinated, eighteen subsequently had typhoid and only one died, whereas out of ten thousand of the general population, two hundred had typhoid and twenty died. These last figures are not exact, as only records of deaths are kept, and for each twenty deaths the rate of mortality and incidence in epidemics in the United States were used, whereas the Bogotá rate is really higher. However, the comparison, such as it is, is interesting.

Medellin

Medellin is the capital of the Department of Antioquia. It is a city of 70,000, and quite progressive. A railroad connects it with the Magdalena River at Puerto Berrio. Dr. Juan B. Montoya y Flores was nominated to represent this district on the committee on credentials. Dr. Flores conducts a small private hospital called "Casa de Salud la Samaritana," and Dr. José V. Maldonado is associated with him. There is another *casa de salud* which is managed by Dr. Gil J. Gil and his associate, Dr. Alfonso Castro.

Barranquilla

Barranquilla has several small hospitals or clinics. The Clinica Moderna is operated by a group. La Casa de Salud is the private hospital of Dr. Jorge E. Calvo, and La Clinica Americana is a small hospital and clinic conducted by Dr. Willis Middleton and Dr. L. M. Drennan, two of my former associates in the Ancon Hospital.

A stock company has started construction of a modern hospital on the Prado in the residential section. It is [illegible] profit, but as a philanthropic work to provide a [illegible] for the city, with the hope that at least the interest on the investment will be earned.

[illegible]

Cartagena is also a medical center and has a small medical school. Its equipment is rather meager and there is not ample material for clinical study in the small charity hospital. Dr. Rafael Calvo, a member of our credentials committee, is dean and professor of otology. A company headed by Dr. Calvo [illegible] of fifty beds, which is conducted on modern lines. Dr. Kempton Taylor is the chief surgeon, and North [illegible] laboratory and X-ray departments have technicians [illegible]

The committee on credentials in Colombia is compiling a list of its eminent surgeons, whom they will recommend for Fellowship in the College.

[illegible]

Arrival

On my arrival in Caracas, I visited our minister, Mr. Willis C. Cook, a very gracious and affable gentleman, who I learned had just arrived in Venezuela to take up the duties of his post. He recommended me by letter to the Minister of External Relations, Dr. Itriago Chacin, whom I visited in company with Señor Manuel [illegible] Sanchez. Dr. Chacin received me warmly, and welcomed any affiliation that might be made [illegible] tendered his hearty support and offices in [illegible] ing such an affiliation.

Dr. Luiz Razetti, distinguished surgeon of Caracas, to whom I presented the letter of [illegible] College of Surgeons to the surgeons of Venezuela, called a meeting of the surgeons on March [illegible] the Assembly Hall of the Academy of Medicine. Twenty-four surgeons were present at this meeting and a committee of five was nominated to wait upon me. This committee met with me in my hotel on March 17 to discuss the American College of Surgeons and the purpose of my visit. All were strongly in favor of the College, its aim and its work, and gladly subscribed themselves as a committee on credentials to further the admission and affiliation of Venezuelan surg[illegible]

[illegible] committee is quite representative of the [illegible] professional attainments. They are:

Luis Rosetti, general surgeon and orthopedist, chairman;
Salvador Cordoba, urologist, secretary;
David Lobo, gynecologist and obstetrician;
J. M. Espino, ophthalmologist;
E. Conde Flores, oto-rhino-laryngologist.

These gentlemen will recommend for Fellowship a selected group of the prominent and qualified surgeons of Venezuela. A partial list of these includes:

Miguel R. Ruiz, Caracas;
Adolfo Bueno, Caracas;
Martin Herrera, Caracas;
P. D. Rodriguez Rivero, Puerto Cabello.

Hospitals of Caracas

The principal hospital of Caracas is Hospital Vargas. It received its name from one of the republic's early physicians and statesmen. Besides many monuments throughout the republic and having this great hospital named for him, this Doctor of Medicine has been honored with a resting place in the National Pantheon. Hospital Vargas is conducted by Sisters, and contains about six hundred beds placed in wards that are grouped on the sides of a great open court and connected by open passageways. The space between the ward buildings is beautifully decorated with flower beds and arbors, making delightful spots that the convalescent can always enjoy.

The operating rooms and laboratories are entirely modern in every way, and in them I saw a high class of work being done, the surgeons using the French technique.

Medical School, Caracas

The medical school is not functioning at present, and medical education is carried on by the old system of tutors and preceptors. The young aspirant, after having served his time under his several preceptors, is examined and asked to present his thesis. If all is satisfactory, he is granted his license to practice medicine. The profession entertains the hope of soon re-establishing the school, and the faculty is nominally existent and ready for work.

Caracas

Caracas, from a sanitary standpoint, is very clean. Venezuela in the past few years has built up a most efficient sanitary department through the untiring efforts of the Director of National Sanitation, Dr. L. G. Chacin Itriago. Dr. Itriago is a relative of the Minister of External Relations, Dr. Itriago Chacin. To distinguish them in official circles they are called respectively Dr. Chacin *adelante* and *detrás*, meaning Doctor Chacin (before) and Doctor Chacin (after). The laboratory of the sanitary department is a great institution of research and investigation. Experts conduct the several departments of chemistry, analysis, bacteriology, epidemiology, and pathology. The director is a man of winning personality, a fine executive, and withal a man of science. I was his guest at a dinner in one of the clubs, and several times during my stay enjoyed his company and informal discussions of his work.

The early arrival of my boat in port prevented me from remaining for a dinner which was to have been given to me as a representative of the College by the surgeons of Caracas. I regret that I was unable to meet once more such a fine body of men.

Venezuela has several cities of importance, all of which have hospitals: Valencia, with a population of 70,000; Maracaibo, 50,000; Barquisimeto, 35,000; and Ciudad Bolivar, 20,000.

Cuba

Surgeons of Havana — Committee on Credentials

After paying my respects to Mr. Philander L. Cable, Chargé d'Affaires of the American Legation in Havana, I met, through an appointment made by Mr. Cable, the Secretary of Sanitation and Public Charities, Dr. Juan Guiteras.

Dr. Guiteras called a meeting of the surgeons for the next afternoon at which I explained my visit as a representative of the American College of Surgeons, and discussed with them the object and aims of the College. All favored the plan of making the College Pan-American in its scope and readily nominated a committee of three to act for Cuba. Those nominated were:

José A. Presno, general surgeon, chairman;
Rafael Menocal, general surgeon, secretary;
Carlos E. Finlay, ophthalmologist.

Recommendations for Fellowship

I met with these gentlemen at a later date at the home of Dr. Presno to inform them more fully of the work engaged in by the American College of Surgeons and the privileges of Fellowship.

I found in Cuba a greater number of specialists than in the other countries. Havana, of course, is a larger city, and the men can more easily limit themselves to their particular branch of work.

The committee recommended for Fellowship a group of qualified surgeons. This list, though not complete, includes:

Havana
Ernesto de Aragon
Julio Arteaga
Gonzalo Arostegui
Claudio Basterrechea
Julio Ortiz Cano
Arturo G. Casariego
Gabriel Casuso, Jr.
José L. Casuso
Manuel Costales
José de Cárdenas
Jorge Dehogues
Gustavo Duplessis
Francisco M. Fernandez
Santos Fernandez
Enrique Fortun
Nicolás Gomez de Rosas
Rodolfo Guiral
Eusebio Hernandez
Alberto Inclan
Pedro Lamothe
Francisco Leza
Anton Lutz
Sergio Garcia Marruz
Emilio Martinez
Rafael Nogueira
Ricardo Nuñez
Felix Pagés
Ignacio B. Plasencia
Luis F. Rodriguez Molina
Emilio Romero
Alberto Sanchez de Bustamante
Enrique Fernandez Sabe
Benigno Souto
Elpidio Stincer
Agustin de Varona

Camagüey
La Herran
Justo Lamar

Cienfuegos
Luis Ros

Cienfuegos
Alfredo Mendez

Manzanillo
Ciro Lens
Mariano Sanchez
Julio Ortiz Coffigny

Pinar del Rio
Leon Cuervo

Sagua la Grande
Enrique Yaniz

Santa Clara
Olivio Lubian

Santiago de Cuba
Antonio Guernica
Donato G. Marmol
José A. Ortiz

Hospitals

Hospital conditions are much better in Havana than in many countries, the total number of hospital beds being about six thousand. There are five training schools for nurses in Cuba, two being in Havana and one each in Santiago, Camagüey, and Matanzas. The largest city hospital is the Calixto Garcia of about nine hundred beds. It has recently been given to the University of Havana Medical School as a teaching hospital. The total cost of its eighteen buildings when finished will be about $700,000.00. Up to date $400,000.00 has been spent in the construction of ten buildings and their equipment.

The Mercedes Hospital of twelve pavilions, with three hundred beds, has a training school of twenty-five pupil nurses, and employs twenty-eight graduates. The Maternity Hospital is conducted by the Health Department, and it too has a training school. There are six graduate nurses and eight pupils. Eight fourth-year medical students act as internes and assist in over three hundred labors per year. This institution comprises a day nursery, and instruction in [illegible] and the Leprosarium, one hundred [illegible].

There are eight hospitals in Havana belonging to Spanish Associations. One of these Associations has 70,000 members, each of whom pays Two Dollars a month and receives free medical and surgical treatment as well as hospitalization. Membership also includes club privileges, and the advantage of courses in bookkeeping, typewriting, languages, mathematics, etc. Many of the Associations have additional income such as theaters, whose earnings are turned into the general fund.

The Asturian Association was originally a Spanish colony. The Spanish emigrant coming to Cuba [illegible] attack of yellow fever, and the men of his native province in Spain banded together to give him medical care until he acquired his immunity, or to give him a [illegible]. The Associations are named after the provinces of Spain, and their hospitals are models of completeness. I visited Covadonga, the Asturian Association hospital, where Dr. Presno is chief surgeon and where I saw him very skillfully do a nephrotomy for calculus. This hospital has beautiful grounds and airy pavilions that accommodate about eight hundred patients. These hospitals are for male patients only, and [illegible] for the work.

[illegible]

The medical school is a part of the University of Havana. I met the distinguished rector of the University, Dr. Carlos La Torre (D.Sc., Harvard, Hon. [illegible]), Dean of the Medical School, Dr. Diego Tamayo. Dr. Tamayo has established a laboratory in Havana and in connection with it a [illegible] school in the specialties. The clinic treats about fifteen thousand [illegible].

The medical school is poorly housed at present and has only a lecture hall, an anatomy building, and the General Wood Laboratory. The faculty hope to be able to sell the old grounds and building and place the school within the grounds of the new University Hospital, recently acquired from the Government.

Department of Health and Charities

The Department of Health and Charities has reached a high point of perfection under the administration of Dr. Juan Guiteras, the Secretary. Dr. Guiteras is known to us through his work in yellow fever with the Reed-Carrol Commission, and in recent years with the late General Gorgas and Dr. Henry Carter. The theory of the mosquito transmission of yellow fever was a Cuban product, and was evolved in the mind of Dr. Carlos Finlay, the father of Dr. Carlos E. Finlay.

Curaçao

While in Curaçao I visited St. Elizabeth's Hospital, which is conducted by Sisters of the order of St. Francis from Holland. There are forty-three Sisters, six of whom are trained nurses. The hospital contains two hundred beds and resembles in administration the hospitals of the States.

The Green Cross Sanitarium of fifty-bed capacity is also well conducted.

Dr. H. Boogart practices general surgery, Dr. M. Goodhart does ear, nose, and throat work, and Dr. H. Ferguson is an ophthalmologist of great prominence in the countries near by. He is quite expert in cataract extraction and enjoys an enviable reputation for such.

In Conclusion

Everywhere on my trip the extension of the American College of Surgeons was enthusiastically received, and a desire to co-operate in the uniting of American surgeons was manifested. It has often been said that an anti North American feeling exists in Latin America, and many regrettable incidents have occurred that would foster such a feeling, if it existed. In racial tendencies, South America has always had a pro-European feeling, that is a sympathetic feeling for the South European countries, France, Spain and Italy, which is quite natural. This should not be interpreted as anti North American. For years men of science from these countries have studied in Europe and have acquired a natural sentiment toward things European, and a bond of friendship exists with its people. It comes partly from the interchange and partly from a love for the motherland. Had we the same understanding of the South American, our association and friendly relations would increase from our propinquity.

If there is one virtue that the North American acquires when he meets and learns to know his South American colleague, it is humility. Rubbing elbows with the men of science of the southland, men who are cultured and refined, who find time for the arts, are linguists and travelers, who in their profession are serious and progressive and after all still have time for play, makes us feel our littleness, our limitations. Whatever it may be, we certainly have missed a lot of the good things of life through the improper proportioning of our study hours. We usually think of the Latin-American as a person of impulse. To jump at conclusions is left for northern blood. The Latin reaches his decisions by deliberation and analysis. His wit is as keen and his humor as deep as the Gael, but his impulsiveness is his passion and is revealed only in love and war. To know the South American is to appreciate a warm friend and to love him.

CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

Fifth Annual Session, Boston, October [illegible]

JOHN B. DEAVER, Philadelphia, *President*

HARVEY CUSHING, Boston, *President-Elect* ALBERT J. OCHSNER, [illegible]

FRANKLIN H. MARTIN, Chicago, *Director-General*

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J. EMMONS BRIGGS — HILBERT F. DAY

FREDERICK J. COTTON — FLORENCE W. DUCKERING

WILLIAM [illegible] — [illegible]

R. B. [illegible] — [illegible]

[illegible] — [illegible]

FRANK H. [illegible] — [illegible]

[illegible] — [illegible]

PLANS FOR THE CLINICAL CONGRESS IN BOSTON

IN the following pages will be found a preliminary program for the evening meetings of the Boston session as arranged by the Executive Committee of the Clinical Congress.

The Congress formally opens on Monday evening with the presidential meeting in Symphony Hall. On this occasion the distinguished foreign guests will be presented, and the President-Elect, Dr. Harvey Cushing, will deliver his inaugural address. Professor Raffaele Bastianelli of Rome, Italy, will present the John B. Murphy Oration in Surgery, taking for his subject "Surgery of the Joints."

Interesting programs have been prepared for the sessions on Tuesday and Thursday evenings in Jordan Hall, at which papers will be read and discussed by eminent surgeons especially selected as qualified to discuss the subjects under consideration.

On Wednesday evening the Fellows and their ladies will be guests of the Boston Surgical Society at a special meeting in Jordan Hall, the occasion being the presentation of the Henry Jacob Bigelow medal to Dr. William Williams Keen of Philadelphia.

At the tenth convocation of the American College of Surgeons to be held on Friday evening in Symphony Hall, fellowship in the College will be conferred upon a group of American and Canadian surgeons, and honorary fellowships upon a number of distinguished foreign guests. Professor Raffaele Bastianelli will deliver the fellowship address.

The following distinguished Latin-American surgeons are expected to attend the Clinical Congress: Dr. José E. Casuso, Dr. José A. Presno, and Dr. Rafael Menocal of Havana, Cuba; Dr. Gabriel M. Malda and Dr. Ulises Valdes of Mexico; Dr. José Arce of Buenos Aires, Argentina; Dr. Claudio J. Sanjines of La Paz, Bolivia; Dr. [illegible] of Rio de Janeiro, Brazil; Dr. Gregorio Amunategui and Dr. Lucas Sierra of Santiago, Chile; Surgeon-General Alberto Adriasola and Dr. Guillermo E. Muennich of Valparaiso, Chile; Dr. Pompilio Martinez of Bogotá, Colombia; Dr. Francisco Graña of Lima, Peru; Dr. Enrique Pouey of Montevideo, Uruguay; and Dr. Louis Razetti of Caracas, Venezuela.

THE [illegible] PROGRAM

The plans for the Boston meeting will in a [illegible] of the Congress. Clinical demonstrations at the hospitals and medical schools will fill the [illegible] sive. The Committee on Arrangements is de-

veloping a program of clinics and demonstrations that will completely represent the clinical activities of that great medical center. All departments of surgery will be represented in this clinical program, including gynecology, obstetrics, orthopedics, urology, surgery of the eye, ear, nose, throat, and mouth, experimental surgery, surgical pathology, roentgenology, etc.

The institutions which will co-operate in providing the clinical program are as follows:

Harvard Medical School
[illegible] University Medical School
Tufts College Medical School
Beth Israel Hospital
Evangeline Booth Hospital
[illegible] City Hospital
[illegible] Dispensary
Boston Lying-In Hospital
Peter Bent Brigham Hospital
Cambridge Hospital
Carney Hospital
[illegible] Hospital
Forsythe Dental Infirmary
[illegible] Hospital for Women
Huntington Memorial Hospital
Long Island Hospital
Massachusetts Charitable Eye and Ear Infirmary
Massachusetts General Hospital
Massachusetts Homeopathic Hospital
New England Deaconess Hospital
New England Hospital for Women and Children
St. Elizabeth's Hospital
U. S. Naval Hospital
Vincent Hospital

HOSPITAL CONFERENCE

The first day of the Boston session, Monday, October 23, will be devoted to a hospital conference. The large attendance, interesting papers, and enlightening discussions at the Philadelphia meeting last year insured a permanent place for a hospital conference at each succeeding Congress. At this conference representative surgeons, hospital superintendents, and hospital trustees will present addresses, to be followed by a general discussion open to all. It is expected that this meeting will present a digest of past performances and current opinions relative to hospital service. Any topic of interest may be presented in the general discussion. A complete program for the conference will be mailed previous to the meeting to all interested in hospital problems.

The following is a partial list of speakers who have been invited to participate in the morning session: Dr. Franklin H. Martin, Dr. Newton E. Davis, Dr. George W. Swift, Mr. John G. Bowman, Dr. Delmar A. Craig, Rev. Charles B. Moulinier, S. J., Dr. E. A. Codman, Mr. Robert E. Jolly, Dr. A. R. Warner, Dr. Frederic A. Washburn, and Dr. M. T. MacEachern.

In the afternoon Dr. M. T. MacEachern will conduct a round table discussion at which the vital hospital problems will be summarized by staff members, superintendents, and members of boards of trustees.

HEADQUARTERS

General headquarters for the Congress will be at the Copley Plaza Hotel, which is centrally located in the Back Bay district. The large ballroom of the hotel, foyers adjacent thereto with other large rooms on the main floor, have been reserved for the use of the Congress, affording ample space for registration and ticket bureaus, bulletin rooms, etc.

Headquarters will be open for registration at 12 M. Monday, October 23. The clinical program for Tuesday will be bulletined during the afternoon, and tickets for Tuesday's clinics will be issued as visiting surgeons register.

REDUCED RAILWAY FARES

The railways of the United States and Canada with but few exceptions have authorized the sale of round-trip tickets to Boston on account of the Clinical Congress at one and one-half the ordinary one-way fare, provided that the journey be made by the same route both going to and returning from Boston. Round-trip tickets will be sold to members only upon presentation of identification certificates issued from the office of the Director-General. Such identification certificates will be issued to all who register in advance, one certificate being sufficient for the individual surgeon and dependent members of his family. Under this arrangement round-trip tickets will be sold from October 19 to 25 in the central and eastern states, and eastern Canada, with a final return limit of November 2.

LIMITED ATTENDANCE. ADVANCE REGISTRATION

Because of the popularity of these annual clinical meetings it has been found necessary in recent years to adopt the plan of limiting attendance to a number that can be comfortably accommodated. The limit of attendance is based upon the result of a survey of the amphitheaters, lecture rooms, and laboratories of the several hospitals and medical schools as to their capacity for accommodating visitors. This plan requires registration in advance on the part of all who expect to attend, and when the limit of attendance has been reached through such advance registration at the office of the College, no further applications will be accepted. This plan insures accommodations at the clinics for all who register

in advance, and the necessity for adopting such a plan will be apparent to all. Already there has been a very large advance registration, and it is probable that the limit of attendance will be reached some weeks in advance of the meeting.

HOTEL ACCOMMODATIONS

The Committee on Arrangements has appointed a Committee on Hotels, with Dr. Stephen Rushmore as Chairman, to aid Fellows in securing hotel accommodations during the Boston meeting. Boston has ample hotel facilities, many first class hotels being located within walking distance of headquarters. Fellows are requested to make their applications for accommodations direct to the hotels named in the list recommended by the Committee as printed below. If difficulty is experienced in securing satisfactory accommodations the matter should be taken up with Dr. Rushmore, 520 Commonwealth Avenue, Boston.

CLINIC TICKETS

Attendance at all clinics and demonstrations is controlled by means of special clinic tickets. This has proven an efficient means of providing for the distribution of the visiting surgeons among the several clinics, and insures against overcrowding. The number of tickets issued for

Each afternoon during the session, a complete program of the following day's clinics will be posted on bulletin boards at headquarters. After the program has been [illegible] tickets for the next day's clinics may be filed, the clinic tickets to be issued the following morning at 8 o'clock. A printed program will be issued each morning which will contain the complete clinical program for the day, with announcements of evening sessions and other information.

REGISTRATION FEE

Plans for the Congress provide that no financial burden may be imposed upon the members of the profession in the city entertaining the Congress. Hence a registration fee of $[illegible] is required of each surgeon attending the annual clinical meeting, such fees providing the funds from which to meet the expenses of conducting the meeting. To each surgeon on registering in advance is issued a formal receipt for the registration fee, which receipt is to be exchanged for a general admission card upon his registration at headquarters in Boston. This card, which is non-transferable, must be presented to secure special clinic tickets and for admission to the evening meetings.

BOSTON HOTELS WITH RATES

	Special Rates		Double Rates	
	With Bath	Without	With Bath	Without
Adams House, 553 Washington St.				
American House, 56 Hanover St.			6 00	4 00
Arlington, 18 Chandler St.	2 50–3 00			
Avery, 24 Avery St.			6 00	
Bellevue, 21 Beacon St.				
Brewster, 19 Boylston St.	3 00–4 00	2 50–3 00		
Brunswick, Boylston and Clarendon	4 00			
Buckminster, 641 Beacon St.	3 00		6 00	
Commonwealth, Bowdoin St.				
Copley Plaza, Copley Square	6 00			
Copley Square, 49 Huntington Ave	4 00		6 00	
Essex, 693 Atlantic Ave	[illegible] 00		7 00– 8 00	
Fritz-Carleton, 1138 Boylston St.		3 00		
Garrison Hall, 8 Garrison St.	3 00		5 00	
Langham, 1699 Washington St.	3 00			
Lenox, Exeter and Boylston	5 00		8 00	5 00
Parker House, School and Tremont	[illegible]	4 00–4 50		
Plaza, 419 Columbus Ave.				3 00
Priscilla (women only), 307 Huntington Ave	3 00			
Puritan, 390 Commonwealth Ave.	[illegible]		6 00	
Putnam, 284 Huntington Ave.				
Quincy, 47 Brattle St.	3 50			3 50–4 00
Ranelegh, 11 Mountfort St.				
Somerset, Commonwealth and Charlesgate				5 00
Stewart Club (women only), 10 Fenway				
United States, 90 Beach St.				
Vendome (American plan), Commonwealth and Dartmouth				
Victoria, 271 Dartmouth St.	4 00		6 00	5 00
Westminster, Copley Square	4 00		7 00	
Young's, Court and City Hall				

PROGRAM FOR EVENING MEETINGS

Presidential Meeting, Monday, October 23—Symphony Hall, 8 P.M.

Address of Welcome: LINCOLN DAVIS, M.D., Boston, Chairman of Committee on Arrangements.

Address of the retiring president: JOHN B. DEAVER, M.D., Philadelphia.

Introduction of foreign guests: RAFFAELE BASTIANELLI, M.D., F.R.C.S. (Hon.), Rome; FRANCIS SEYMOUR KIDD, M.Ch., F.R.C.S., London; ANDREW FULLERTON, C.B., C.M.G., Belfast; EINAR KEY, M.D., Stockholm.

Inaugural Address: HARVEY CUSHING, M.D., Boston.

The Doctor John B. Murphy Oration in Surgery—"Surgery of the Joints": RAFFAELE BASTIANELLI, M.D., F.R.C.S. (Hon.), Rome.

Tuesday, October 24—Jordan Hall, 8 P.M.

EINAR KEY, M.D., Stockholm: Treatment by Embolectomy of Circulatory Disturbances in the Extremities Due to Emboli.

SYMPOSIUM: Genito-Urinary Surgery.

HUGH H. YOUNG, M.D., Baltimore: Prostatectomy—Preparatory, Operative, and Post-Operative Methods.

FRANCIS SEYMOUR KIDD, M.Ch., F.R.C.S., London: Simple Mesodermal Tumors of the Urinary Bladder; with the Report of a Case Treated by Operation.

ANDREW FULLERTON, C.B., C.M.G., Belfast: A Note on Unilateral Diuresis.

J. BENTLEY SQUIER, M.D., New York: The Surgery of Vesical Neoplasms.

Discussion: WILLIAM C. QUINBY, M.D., Boston; ALEXANDER RANDALL, M.D., Philadelphia; JOHN T. GERAGHTY, M.D., Baltimore; JOHN H. CUNNINGHAM, M.D., Boston.

Wednesday, October 25—Jordan Hall, 8:30 P.M.

SPECIAL MEETING OF THE BOSTON SURGICAL SOCIETY

Introductory Remarks: ROBERT W. LOVETT, M.D., Boston, President.

Presentation of Henry J. Bigelow Medal to WILLIAM WILLIAMS KEEN, M.D., Philadelphia.

"Sixty Years Ago—1862 to 1922": WILLIAM WILLIAMS KEEN, M.D., Philadelphia.

Thursday, October 26—Jordan Hall, 8 P.M.

SYMPOSIUM: Carcinoma of the Jaws, Tongue, and Cheeks and Lips.

GEORGE W. CRILE, M.D., Cleveland: General Principles Involved in Operations; Summary of Results Obtained in the Crile Clinic, with Special Reference to Treatment of Carcinoma of the Jaws.

EDWARD S. JUDD, M.D., Rochester, Minn.: Summary of Results Obtained in the Mayo Clinic, with Special Reference to Treatment of Cancer of the Tongue.

GEORGE E. BREWER, M.D., New York: Summary of Results Obtained in the Presbyterian, Memorial, and Roosevelt Hospitals of New York, with Special Reference to Treatment of Cancer of the Cheeks and Lips.

Discussion: ROBERT B. GREENOUGH, M.D., Boston; ALBERT J. OCHSNER, M.D., Chicago; VILRAY P. BLAIR, M.D., St. Louis; JOSEPH C. BLOODGOOD, M.D., Baltimore; DOUGLAS A. QUICK, M.D., New York; GEORGE P. MULLER, M.D., Philadelphia; H. R. GAYLORD, M.D., Buffalo; ALEXANDER E. GARROW, M.D., Montreal; CHANNING C. SIMMONS, M.D., Boston.

Friday, October 27—Symphony Hall, 8 P.M.

CONVOCATION OF THE AMERICAN COLLEGE OF SURGEONS

Invocation: Reverend Doctor ALEXANDER MANN, Boston.

Conferring of Honorary Fellowships.

Presentation of Candidates for Fellowship.

Presidential Address: HARVEY CUSHING, M.D., Boston.

Fellowship Address: RAFFAELE BASTIANELLI, M.D., F.R.C.S. (Hon.), Rome.

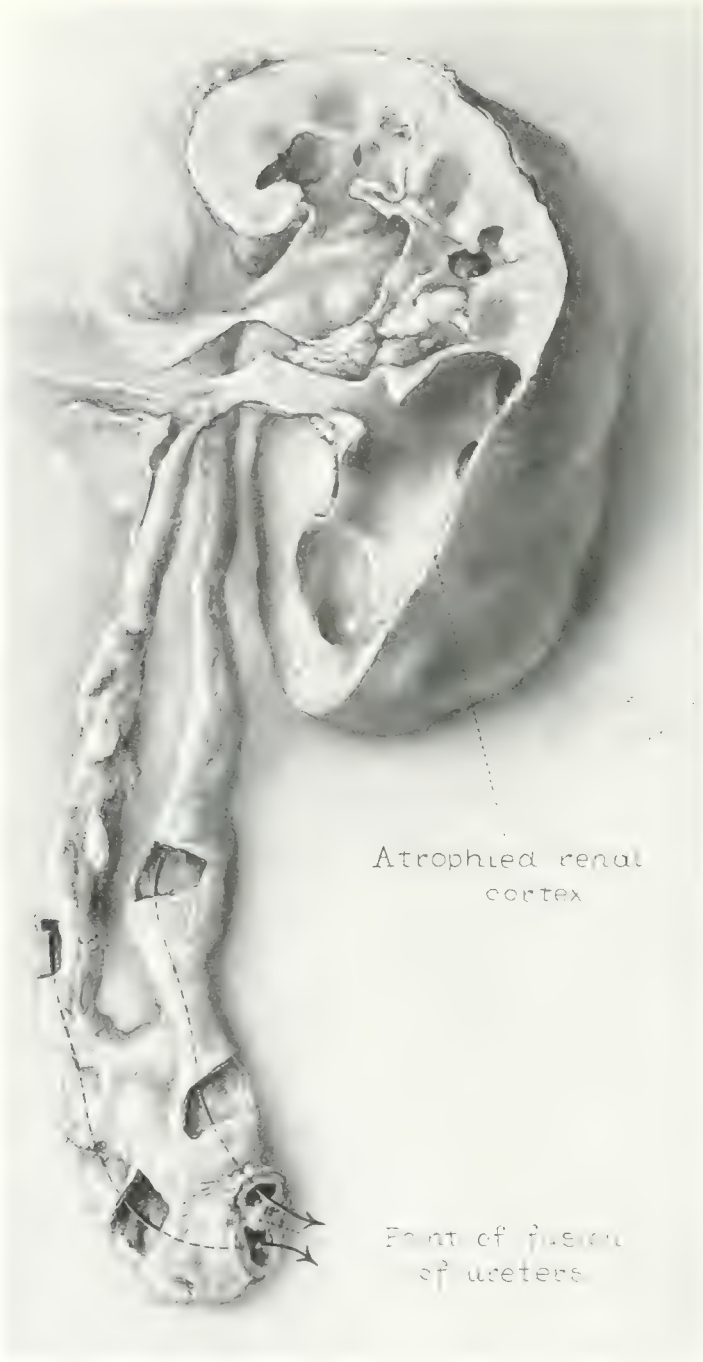

Fig. 10. (Case 5-A81801.) Extensive hydronephrosis of both segments of a double kidney. The ureters are fused at the ureterovesical juncture.

Pathological Complications with Duplication of the Renal Pelvis and Ureter.—*William F. Braasch and Albert J. Scholl, Jr.*

SURGERY, GYNECOLOGY AND OBSTETRICS

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PATHOLOGICAL COMPLICATIONS WITH DUPLICATION OF THE RENAL PELVIS AND URETER (DOUBLE KIDNEY)

BY WILLIAM J. BRAASCH, M.D., ROCHESTER, MINNESOTA

SECTION ON UROLOGY, MAYO CLINIC

AND

ALBERT J. SCHOLL, JR., M.D., ROCHESTER, MINNESOTA

FELLOW IN UROLOGY, THE MAYO FOUNDATION

ANOMALIES in the urinary tract of themselves are of no clinical significance. It is only when some pathological complication occurs that their recognition becomes of clinical as well as surgical importance. Pathological, and particularly surgical, complications are prone to develop in the presence of such anomalies, and their clinical discovery is, therefore, comparatively frequent.

The most common anomaly in the urinary tract is duplication of the renal pelvis and ureter; such duplication may be unilateral or bilateral, complete or incomplete. When it occurs in a solitary kidney, it is usually termed fused or horseshoe kidney. That duplication is comparatively common is evident from the literature; in fact, it is so common that its discovery is not generally reported unless some unusual incident accompanies it. An excellent review of 300 cases largely collected from the literature is given by Mertz in a recent series of papers. It is of interest that in 27 per cent of these cases the duplication was bilateral. The comparatively high incidence of ectopic ending of the duplicated ureter as reported in the literature is also of unusual interest; this occurred in 42 (30 per cent) of a series of 140 patients having complete ureteral duplication.

One hundred forty-four patients with duplication of the renal pelvis and ureter were observed in the Mayo Clinic from 1907 to 1922. The conditions were divided anatomically into unilateral, 135 (94 per cent) and bilateral, 9 (6 per cent). The duplication of the ureter was subdivided into complete unilateral, 36 (25 per cent); incomplete unilateral, 99 (68.7 per cent); complete bilateral, 8 (5.5 per cent), and incomplete bilateral, 1 (0.7 per cent). In the complete unilateral duplications, there was an ectopic ending of the duplicated ureter in 3 cases (2 per cent). Doubtless the relative occurrence of bilateral duplication reported in this series is not exact, particularly in relation to the occurrence of partial duplication of the ureter. Nevertheless, it is hardly possible that the percentage of error in our cases would approximate the bilateral occurrence of 27 per cent, as found by Mertz.

The comparatively large number of patients with bilateral duplication which have been reported in the literature may be explained by the fact that this unusual condition is reported, while the more ordinary unilateral occurrence is not. The comparatively common occurrence of ectopic ending of the duplicated ureter as reported in the literature probably is also exaggerated and can be similarly explained.

Presented before the Urologic Section, New York Academy of Medicine, New York, February 1, 1922.

ANATOMY

The position of the kidney with duplicated pelvis and its relation to the surrounding tissues are usually normal. The double kidney which is usually larger than normal varies in size, as a rule, with the distance separating the pelves. The two renal segments are generally separated externally by a depression which varies from a shallow notch to a deep broad groove; occasionally this external evidence of division may be lacking, or it may be so marked that only a fibrous band unites the two segments, as in a case described by Marion. Although there may be a definite external division of the two renal segments and the pelves may be widely separated, our microscopic examination of the intervening tissues showed that there was no apparent division in the cellular structure of the two segments. In an occasional case the two pelves are so close together that a partial resection is impossible. When external demarcation of the two segments exists, the upper segment is, in most cases, smaller than the lower. Even though the double kidney is somewhat larger than ordinary, the combined renal function of the two segments is generally normal. Although there is usually a difference in size between the pelves of the two segments, we have found that the differential function of one segment is usually equal to that of the other. In two instances the phenolsulphonephthalein return from each segment was 7 per cent in 15 minutes.

The division of the tip of the renal bud into the branches of the renal pelvis may give rise to a great variety of forms. The usual short cleavage of the ureteral bud sometimes continues and forms partial duplication of the pelvis. One of these divisions or calices (usually the cephalad) may form a pelvis as large as the original. As a result of ureteral obstruction in this type of case, hydronephrosis, when it occurs, will involve both pelves. Duplication of the pelvis may be said to be complete only when the several pelves or their portions have separate ureters or ureteral divisions. Sometimes the renal bud divides into three or four separate elongated calices, each of which has a separate branch running to the ureter; these unite just beyond the hilum without forming a true pelvis. In one of the cases of this series (Case 9-A308206) the pelvis was entirely extrarenal, situated about 6 centimeters from the hilum of the kidney, and above it the two major calices extended into the renal substance, where they divided into the minor calices. Occasionally, the ureteral divisions leading from the duplicated pelves will unite close to the kidney, or even within the kidney, so that resection or division of the ureter is obviously impossible (Fig. 1).

In cases of complete duplication of the ureter, crossing often occurs just above the bladder and also below the ureteropelvic juncture; but this is probably not of clinical importance. Often there is only one crossing or none at all; occasionally the two ureters are wound around each other, or they are in close apposition and may be inclosed partially or entirely in a common sheath, adding greatly to the difficulty of preserving the sound ureter following a partial resection of the kidney with the attached ureter. As a rule, the ureters leave the pelves at a normal angle; in incomplete duplication the ureteral division may occur at any level. In our series the upper one-third of the ureter was most often duplicated (Fig. 2). Ectopic ending of an aberrant ureter has been described as occurring in the vagina, urethra, seminal vesicle, ejaculatory ducts, and in the anatomical areas represented by the permanent disposition of the wolffian duct. In our series, ectopic ending was found in the urethra in two instances and in the vagina in one.

HISTOLOGICAL STRUCTURE

Sections taken from the interrenal tissue in most cases show complete histological unity of the two segments. In some cases the capsule dips down into the renal mass, causing a partial division of the renal tissue. In the specimens examined glomeruli were commonly found in the parenchyma between the two pelves. In one case the tubules of the two segments were adjacent but definitely separated, each associated with its own glomerulus. Various transitions from an almost complete separation by fibrous tissue to an indistinguishable intermingling of parts were

Fig. 1.

Fig.

Fig.

Fig. 1. (Case A199670.) Partial duplication of kidney with normal minor calices.

Fig. 2. (Case A241859.) Duplication with fusion of ureters in the upper third.

Fig. 3. (Case A331059.) Complete unilateral duplication of kidney with a small upper and a [illegible] lower pelvis.

found. In cases of infection the intervening tissues invariably showed round-cell infiltration and fibrosis, and in a few, destruction of the parenchymal or tubular cells. These pathological cellular changes extended into the apparently normal segment to a variable extent.

DIAGNOSIS

As a rule, under normal conditions, complete duplication of the pelvis and ureter can be diagnosed with comparative ease. The condition is usually recognized by cystoscopic inspection, or more definitely by the aid of lead catheters and the pyelo ureterogram (Fig. 3). If the duplication of the ureter is incomplete and occurs above the bladder it cannot be discovered unless a routine pyelo-uterogram is made. The presence of a pathological complication in one or both segments and the resulting deformity may render recognition of the condition exceedingly difficult.

Cystoscopic inspection. The cystoscopist, accustomed to finding one ureteral opening on each side of the trigone, does not usually look for a third. The careful observer, however, should always be on the lookout for the third orifice. The duplicated orifices are usually situated at the normal site in the lateral portion of the trigone, separated by a distance of 1 to 2 centimeters. They are both, as a rule, easily seen in the normal bladder in the comparatively small field of the direct vision cystoscope. The openings may, however, be very widely separated and are occasionally situated in unusual portions of the bladder. When they are widely separated the cystoscopist is not always to blame for failure to find the supernumerary orifice, and consequently overlook the duplication.

An aberrant ureter, opening into the urethra or vagina, may be difficult to find, but the use of indigocarmine, as suggested by Mertz, facilitates the discovery. Since urinary incontinence is present in this condition, every case of incontinence which is not otherwise explained should suggest the possibility of the ectopic opening of an accessory ureter.

If pathological complications have not obscured the opening of the diseased ureter or caused marked abnormality in the bladder, the duplicated openings will have no unusual

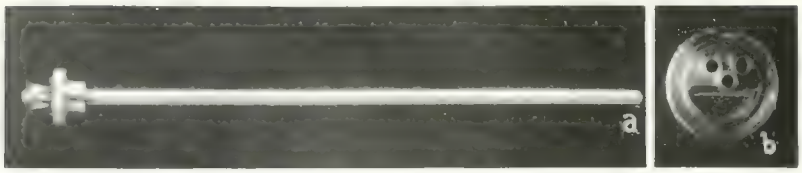

Fig. 4. a, Catheterizing guide for three catheters. b, End of catheterizing guide.

characteristics. Occasionally one or both may be small, or situated on a slight papilla and easily overlooked. Slight depressions may be visible in the mucosa adjacent to an orifice which may be suggestive of a duplication, and thus confused by an over-zealous observer. A ureteral orifice in or adjacent to the sphincter may easily be overlooked, particularly if the average lens cystoscope is used. When the ureter is divided above the bladder, there is, of course, but one orifice and this will not present any peculiarities suggestive of duplication. Complete bilateral duplication of the ureter and pelvis, with four ureteral openings in the bladder, should be no more difficult to recognize than unilateral duplication. The two ureteral openings may be found in the usual position on each side of the trigone. If tuberculosis involves one pelvis and ureter, the resulting contraction of the ureter may place the duplicated openings in unusual positions. As the result of the infection, deformity of the bladder and changes in the mucosa adjacent to the affected orifice may obscure them. In cases of atrophy of the ureter leading from a functionless renal segment, the orifice may become obliterated.

Ureteral catheterization. Data obtained by means of the ureteral catheter alone in cases of complete unilateral duplication of the ureters is not of much practical importance, except with regard to the existence of pathological complications in the ureter. The usual method of catheterizing the three ureters consists of a preliminary catheterization of one, followed by removal of the cystoscope and its reintroduction in order to catheterize the other two. The procedure, which may be attended by technical difficulties and discomfort to the patient, can be obviated by the use of a three-catheter guide which we have constructed in order to permit simultaneous catheterization of the three ureters (Fig. 4). The question may arise, in cases of duplicated pelvis, as to whether there is a direct connection between the two pelves. This can readily be ascertained by injecting a solution colored with methylene blue into one catheter; if the dye returns immediately from the second catheter, it is quite evident that the separation of the two pelves is incomplete. Further corroboration is available by means of pyelography. If the two ureters unite soon after leaving their respective openings, as occurred in one case previously reported (2, 3), the second catheter introduced will meet the obstruction at the point of union. If there is a single opening and the ureter is divided in the upper portion, obstruction, or any other evidence of the division, is seldom found by the ureteral catheter.

It is often of value to estimate the comparative function in the two segments of the double kidney. In the diseased segment the extent of the pathological process may be estimated, if the dye secretion is absent or greatly diminished. Of even greater value is the determination of the degree of function in the supposedly normal segment. If the return of the dye from this segment is greatly diminished, heminephrectomy should, of course, not be considered, even though the exterior of the segment appears fairly normal.

Pyelo-ureterography. More exact data concerning the anatomical structure of the duplicated pelvis and ureter, as well as of pathological complications, may be obtained by combining the roentgen-ray and the cystoscope as in the pyelogram and the ureterogram (Figs. 5 and 6). If duplication is complete, the lead catheter will outline the course of the two ureters and the position of the two pelves in the pyelo-ureterogram. The lead catheter will be of little value, however, if the ureter is divided above the bladder, since it can follow but one branch. The pyelo-

Fig. 5. (Case A293833.) Opaque catheters inserted into both pelves of double kidney. The lower pelvis injected with sodium bromide.

Fig. 6. (Case A290090.) Complete bilateral duplication. Opaque catheters in both pelves of left kidney injected with sodium bromide.

ureterogram offers the only method by which such partial duplication can be determined (Fig. 7). With incomplete duplication of the ureter, even though the end of the catheter is in one of the pelves, the injected bromide solution will usually flow back alongside the catheter so as to outline the divisions of the ureter and the second pelvis as well. When the ureteral division is close to the bladder, the second ureter may be outlined by reinjection through the partially withdrawn catheter, as is routinely done at the clinic in pyelo-ureterography.

The relation of the two pelves as outlined in the pyelogram may be of value in determining (1) the distance separating them, (2) direct communication, and (3) the relative size. By routine pyelo-ureterography at the time of cystoscopy, incomplete duplication undoubtedly will be discovered more often in the future. It is of practical importance to ascertain as nearly as possible the amount of tissue separating the two pelves, since if there is considerable, surgical separation is much easier. There is usually a marked difference in the outline of the two pelves, as well as in the size. The smaller pelvis is usually situated cephalad and its calices are smaller than normal in size and contour (Fig. 8). If a small pelvis is outlined in the pyelogram and, particularly if it is high lying, the possibility of duplication with occlusion of the other ureter and pelvis must be considered and a search made for evidence. Obliteration of one branch of a double ureter may be surmised when the branch of the ureter leading to the normal pelvis is smaller than the combined ureter. The point of ureteral division may be indicated by a localized irregularity in cases in which the smaller normal branch leaves the combined ureter. Even though data from cystoscopic inspection and ureteral catheterization are negative, the existence of duplicated pelves and ureters must be considered, if (1) the patient's recent history is suggestive of renal involvement; (2) there is much pus in the urine without apparent cause, being found on cystoscopic

inspection, or (3) there are shadows suggestive of stone in the renal region which are apparently excluded in the pyelogram. The duplicated ureter or pelvis may become occluded so that cystoscopic data are negative and the pyelogram does not show the duplication. In case of recent occlusion of one branch of a duplicated ureter, it is easily possible that a pathological complication in the involved pelvis would be overlooked. In a pyelogram the shadows of stones or of a calcareous area of tuberculosis situated in the occluded portion of the double kidney might appear to be extrarenal because of their distance from the outlined pelvis (Fig. 9). The same error would, of course, arise in the presence of complete duplication of the ureter when the second orifice is overlooked on cystoscopic examination.

PATHOLOGICAL COMPLICATIONS

Mertz found that pathological complications occurred in 80 (30 per cent) of the 300 cases reported. The 144 patients in our series may be divided, according to incidence of pathological conditions, into: Group 1, those who were operated on, 30; Group 2, those having definite pathological lesions who were not operated on, 24; Group 3, those in whom the evidence of pathological lesions was doubtful, 29; and Group 4, those without evidence of pathological complication in whom the discovery of the condition was purely accidental, 61 (42 per cent.). Fifty-four (37.5 per cent.) of the 144 patients were found to be suffering with definite pathological complications (Groups 1 and 2).

In the 30 patients in Group 1 who were operated on, the various lesions described were: ureteral obstruction with hydronephrosis or pyonephrosis in 8, renal tuberculosis in 6, renal lithiasis in 7, ureteral lithiasis in 3, and atrophic pyelonephritis in 4. In one case the aberrant ureter from the upper segment opened into the vagina; in another an anomalous vessel crossed the ureter causing obstruction. The lower segment of the kidney was primarily involved in 9, and the upper in 5; both segments seemed equally involved in 13. It is evident that the pathological complication is confined largely, if not entirely, to one segment in about one-half of the cases, and, furthermore, that the lower segment is more often affected than the upper.

Of the 24 patients in Group 2 who were not operated on, essential hæmaturia occurred in 4, unilateral infection in 2, bilateral infection one incomplete bilateral duplication) in 9, ptosis in 3, ureteral stones passed after manipulation in 3, and stone in the lower pelvis of a double kidney, left intact because of various complications, in 3.

The fact that 15 of the 24 patients had chronic renal infection, is suggestive of possible lowered resistance because of the anatomical deformity. The three stones removed by manipulation were all near the ureterovesical juncture and not related to the division of the ureter.

The 29 patients, in whom no definite evidence of disease was determined, had attacks of pain suggestive of renal colic referred to the renal and ureteral areas. In many cases the pain was accompanied by fever and chills with temporary urinary symptoms. Neither by cystoscopic examination nor urography could definite evidence of a lesion be demonstrated, although in several instances the pyelogram showed moderate distention of the calices. General examination did not reveal extrarenal cause of the symptoms in the majority of cases. It would seem logical to assume that the anatomical deformity was subject to temporary urinary obstruction or infection.

SURGICAL TREATMENT

Thirty operations were performed on patients with duplicated pelves as follows:

	Cases
Nephrectomy	15
Heminephrectomy (two requiring complete nephrectomy later)	4
Pelviolithotomy	6
Ureterolithotomy	1
Cutting of anomalous blood vessels to relieve hydronephrosis	1
Ligation of aberrant (upper) ureter opening into the vagina	1

The surgical treatment of pathological complications, other than lithiasis, which affect the double kidney will, in the majority of cases, be radical, necessitating nephrec-

Fig. 7 Fig. 8

Fig. 7. (Case A277876.) Three separate pelves leading from a common ureter.

Fig. 8. (Case A299173.) Complete unilateral duplication; moderate hydronephrosis in the lower segment

[illegible] with sodium bromide. His [illegible] stones.

tomy. Although infection, particularly if it is chronic, may be largely confined to the primary segment, it usually will invade the other segment to such an extent that nephrectomy is advisable. Conservative operation is permissible only in the presence of lithiasis, early localized infection other than tuberculosis, or small hydronephrosis confined to one segment. Nephrolithotomy or pyelolithotomy offers no greater technical difficulties in the double kidney than in the normal. A small stone in the pelvis, however, may be easily overlooked unless the duplication is recognized. In one case in our series, ligation of an anomalous renal blood vessel which constricted one of the ureters was sufficient permanently to remove obstruction to urinary drainage. In the case in which an aberrant ureter ended in the vagina the secretion from one segment was markedly diminished. The ureter was ligated and the patient had no complications other than the usual reaction following ligation. This would suggest the possibility of treating hydronephrosis in the double kidney, when not too extensive or infected, by merely ligating the ureter of the affected segment.

Heminephrectomy. Resection of the diseased segment of a double kidney, on first thought, seems to be a formidable procedure. When conditions are favorable, however, it offers no great technical difficulties and is followed by favorable results. Owing to the fact that opportunities for the operation are limited and the anatomical conditions are often not recognized, heminephrectomy has seldom been performed in the past. If there is considerable pyelonephritis in the resected segment, infection often spreads to the remaining portion after heminephrectomy, the urine which may have been normal prior to the first operation becomes infected, and subsequent nephrectomy is necessary.

Heminephrectomy has been reported as successful by Albarran, Le Dentu, Lennander, Pawloff, Mayo, Rumpel, Young, and Herrick. Albarran reported a case of a double kidney on the left side in which there was a [illegible]

isthmus of connecting tissue. The lower segment was normal; the upper segment was pyonephrotic and was successfully resected. Le Dentu resected an upper segment which contained a small dilated pelvis; although the lower segment appeared to be fibrous and showed chronic nephritis, it was allowed to remain. A fistula persisted for 4 months. Lennander resected a lower segment which he described as being pyonephrotic. Pawloff described the resection of one segment for hydronephrosis. Young resected an upper segment which was atrophic and contained a branched stone.

In two cases in this series (Cases 3 and 4) primary heminephrectomy was performed, but evidence of renal infection and persistence of symptoms made it necessary to perform a secondary nephrectomy; at the time of primary operation the remaining segment had appeared to be normal. In Case 3 the urine collected from the segment prior to operation was normal and the phenolsulphonephthalein excretion 8 per cent in 15 minutes. Heminephrectomy had been performed because of a small infected hydronephrosis and stone in the lower segment with apparently successful results. Within a few months, the patient had dull pain referred to the affected kidney and other evidences of renal infection. Seven months after operation, catheterization of the remaining segment showed marked renal infection; only a trace of phenolsulphonephthalein was returned in 15 minutes. Nephrectomy of the remaining segment was performed, and examination showed diffuse pyelonephritis with atrophy. It is evident that heminephrectomy should not be attempted unless the pathological condition is confined entirely to one segment and clinical evidence shows definitely that the remaining segment is normal and functioning. Even under such favorable circumstances infection may invade the remaining segment, necessitating a secondary operation. With proper suturing the postoperative hæmorrhage should be negligible. If infection remains in the tissues, however, a sinus may persist indefinitely and reopen at intervals. The healing process resulting after heminephrectomy was clearly shown in the segment of a double kidney which was subsequently removed. The resected surface, though pitted in some areas, was smooth, and had assumed the normal rounded contour of one of the renal poles. The pathological process had involved only the tissues immediately adjacent to the line of incision. There was moderate lymphocytic infiltration, in some areas, possibly caused by absorbed suture materials. The glomeruli were somewhat clumped and the destruction of interglomerular tissue was greater than that of glomeruli. There was only slight fibrosis and hyalinization of the glomeruli, and many immediately adjacent to the line of incision were apparently normal. Factors rendering operation easier and favorably influencing the results are (1) considerable distance separating the two pelves; (2) definite division of the two segments by a cicatricial band, and definite confinement of the disease to one segment, and (3) chronic and cicatricial nature of the pathological lesion.

Hydronephrosis. The most common lesion requiring surgical treatment is hydronephrosis caused, usually, by the obstruction of one ureter. Whether this occurs at the point where the ureters cross one another and is the result of this crossing, as suggested by Pawloff, has not been definitely proved. It seems probable, however, that in some cases the ureteral obstruction is the result of stricture due to congenital anatomical defect. In several of the cases herein reported, stricture in the lower ureter was associated with marked dilatation of the ureter above, comparatively little dilatation of the renal pelvis itself, and marked cicatricial pyelonephritis in the peripelvic renal tissue. In cases of large hydronephrosis, the surrounding tissues usually become involved and atrophied and the infection may spread to the other renal segment.

Tuberculosis. In six cases of Group 1 nephrectomy was performed for tuberculosis. In four the disease was largely confined to the lower segment. In each case a distinct cicatricial band separated the two segments, which evidently represented nature's determined effort to confine the disease to the segment in which it originated. If partial resection of the kidney for a localized area of tuberculosis could ever be considered, no more

favorable opportunity could be discovered. However, microscopic examination of every such kidney removed showed that isolated giant cells had invaded the apparently normal tissue adjacent to the area of tuberculosis.

Chronic tuberculosis confined to one pole of a single kidney, if caseated or fibrous and walled off from the remaining apparently normal renal tissue, may easily be confused with tuberculosis involving one segment of a double kidney. The pelvis of the diseased segment may be obliterated and the ureter be atrophied or involved in localized perirenal adhesions and thus difficult to identify. The original pelvic duplication of the kidney doubtless has been occasionally overlooked.

Atrophic pyelonephritis. The atrophic or cicatricial form of pyelonephritis is of comparatively common occurrence and may offer unusual difficulty in clinical diagnosis. Although the process may be confined largely to one segment, the other is often also involved so that in most cases nephrectomy is necessary. In the pyelogram the usual, small, abbreviated pelvis of the upper segment of a normal double kidney may be confused with the contracted pelvis usually observed in atrophic pyelonephritis in the single kidney. A differential phenolsulphonephthalein estimate should establish the diagnosis, since in atrophic pyelonephritis return of the dye is greatly reduced, varying from a trace to 1 or 2 per cent in 15 minutes; in a duplicated pelvis the return is generally at least 6 or 8 per cent.

HEMINEPHRECTOMY: FOUR CASES

Case 1. (A308528.) Miss K. M., age 27, came to the Clinic because of frequent short attacks of pain on the right side. For the last 3 years, pain at times had become very severe, and discomfort had been almost constant. Appendectomy had been performed, but the character of the pain remained unchanged.

The physical examination was negative. The urine contained a few pus cells, and the two-hour return of phenolsulphonephthalein was normal. Roentgen-ray examination revealed a branched irregular shadow in the renal area. At cystoscopic examination the bladder, urine, and ureters were found to be normal. Phenolsulphonephthalein return in 15 minutes was 12 per cent from the left ureter and 5 per cent from the right. A pyelogram revealed a double pelvis on the right; the branched, irregular shadow was obscured in the lower pelvis. A diagnosis of [illegible] stones in the lower pelvis [illegible]

At operation a moderately enlarged kidney was located [illegible] centimeters below the two pelves. The lower pelvis was small and contracted and contained several stones. The [illegible] obstructed by a small stone which had lodged at the point of juncture with the upper ureter. The lower segment of the kidney, which was demarcated from the upper by a deep groove, was dissected free at the juncture of the middle and lower thirds. A [illegible] portion had a separate blood supply, the artery and vein to the lower portion were ligated and cut. The ureter was excised close to its juncture with the upper segment and removed with the lower segment of the kidney. The line of incision on the remaining renal segment was sutured and covered with a fatty fascial flap. The portion of the kidney removed contained a branched stone, several small stones, and several cortical abscesses with small stones. Postoperative recovery was rapid; several times a small sinus at the lowest angle of the incision drained a few drops of pus and then [illegible] later, the patient was perfectly well.

Case 2. (A57428.) Mrs. M. C. T., age 32, came to the Clinic because of a general sense of discomfort in the right side of the abdomen of 7 years' duration. Four weeks before, abdominal discomfort had increased.

Physical examination was negative except for a palpable right kidney. Urinalysis and the roentgen ray examinations were negative. Cystoscopic examination revealed complete duplication of the right ureter. Right pyelograms revealed a stricture of the inner ureter near the bladder wall with a hydroureter above. The pelvis connecting with this ureter was apparently not dilated; the lower pelvis and ureter were normal. A diagnosis was made of double kidney and ureter with a hydro-ureter draining the cephalad segment.

At operation a double right kidney was found with complete duplication of the ureter and pelvis. The ureter draining the upper pelvis was dilated to the size of the small intestine down to a strictured point near the bladder. Each half of the kidney had its own blood vessels. The ureter and blood vessels to the upper portion were ligated and the upper half of the kidney resected. The ureter was dissected to [illegible] centimeters above the bladder where it was ligated and cut. The remaining section of the kidney was sutured with catgut. The patient's recovery was uneventful and, 1 year later, she was much improved, although she had pain occasionally in the right side.

Case 3. (A57581.) Mr. H. S. H., age 45, came to the Clinic with attacks of pyuria associated with chills and fever. Seven years before he had had a short spell of hæmaturia and had passed a small stone. For the last 3 years, he had had intermittent attacks of left abdominal pain.

Physical examination revealed tenderness in the left loin. The urine contained pus and blood. The

roentgenogram contained a shadow in the left renal area. Cystoscopic examination revealed two adjacent ureteral openings on each side near the usual site of the trigone. On the left side the upper opening was dilated and exuded cloudy fluid; the urine from the lower was normal. A roentgenogram taken after the insertion of four lead catheters showed complete bilateral duplication; the pyelogram taken on the right side showed that the upper and lower pelves were connected by a common calyx. A left pyelogram made through the infected ureter revealed a dilated pelvis which accounted for the shadow in this area. The diagnosis was complete bilateral duplication of the ureters and pelves with calculous pyonephrosis in the lower segment of the left kidney.

At operation a double kidney with two ureters and two pelves was found; the lower pelvis was dilated and soft; it contained a stone and a small papilloma, probably a result of irritation. There was a definite line of demarcation between the two portions of the kidney; both segments had a separate blood supply. The ureter and blood vessels to the lower half were tied and cut and the lower portion of the kidney was resected. The patient recovered from the operation rapidly.

Seven months after the first operation, the patient returned complaining of almost constant pain in the region of the left kidney. The function from the right side was normal; that from the left, very slight. At a second operation the remaining portion of the kidney was removed. This portion of the kidney was apparently normal, except for moderate thickening and fibrosis of the renal pelvis. The area from which the pelvis had been removed at the previous operation was smooth, well healed, and without adhesions. Eleven years later, the patient had no trouble attributable to his renal condition.

Case 4. (A232839.) Mrs. B. S. P., age 41, came to the Clinic because of hydronephrosis. Two years before she had had an attack of hæmaturia of 2 weeks' duration. Since then she had had several attacks of fever, chills, and pain in the left kidney area, associated with frequency.

The physical examination was negative. The urine contained pus cells but no bacilli of tuberculosis. The roentgenogram showed multiple shadows in the left renal area. On cystoscopic examination bilateral ureteral duplication was found; two ureters opened on the right of the trigone and two on the left. The phenolsulphonephthalein return from the left upper ureter was 10 per cent in 15 minutes; from the lower, zero. A pyelogram after injection of both of the left ureters revealed complete duplication of pelvis and ureter; the multiple shadows seen in the roentgenogram of the kidney were confined to the lower pelvis. The diagnosis was complete bilateral duplication with hydronephrosis and stones in the lower left renal segment.

At operation a double left kidney was found; the lower portion consisted of a hydronephrotic sac 12 centimeters in diameter containing several stones. The hydronephrosis was caused apparently by kinking of the ureter by an anomalous blood vessel; the stones were secondary to the dilatation and infection. The sac was dissected out and the lower part of the kidney amputated; the upper two-fifths with the small pelvis and ureter were left intact. The cut surface was sutured with catgut. Following the operation the patient had a constantly high temperature and the wound drained freely. One month later, the wound was reopened and the remaining portion of the kidney was removed; it contained a moderate amount of normal tissue, but gave evidence of chronic infectious nephritis. The patient improved rapidly and, 3 years later, was in good health.

NEPHRECTOMY FOR HYDRONEPHROSIS: SIX CASES

Case 5. (A81801.) M. D., a baby girl, age 9 months, was brought to the Clinic on account of abdominal cramps and fever of 4 weeks' duration. The baby looked septic and on examination a movable tender mass was found in the left side of the abdomen. On exploration the left kidney was found to be about twice the size of a normal adult kidney; double ureters were fused just above the bladder at a point where distinct narrowing was made out. The common ureter was divided above the bladder and removed with the renal mass. The kidney was composed of two greatly dilated and thickened pelves separated from one another by a thin layer of renal tissue; the minor calices were obliterated. There was almost complete obliteration of the renal tissue (Fig. 10, frontispiece). One year later, the child was in excellent health.

Case 6. (A151528.) Mrs. B. C., age 52, came to the Clinic complaining that she had been feeling weak and run down since her last confinement, 16 years before. For the last 4 months, she had had a dull pain in her back and frequency of micturition.

The urine contained pus cells. The roentgenogram contained a small shadow in the region of the left kidney. On cystoscopic examination, an impassable obstruction was found in the left ureter 20 centimeters from the bladder. The urine from the left side contained pus; from the right the urine was normal. The phenolsulphonephthalein return from the left kidney was 1 per cent in 15 minutes. A diagnosis of left pyonephrosis was made.

At operation a double kidney was removed. Both pelves were dilated. The ureters connecting the two pelves united 3 centimeters below. They were almost completely obstructed at the juncture by a small stone which accounted for the shadow seen in the original roentgenogram. There was only moderate destruction of the renal parenchyma. The upper segment was smaller than the lower and its pelvis was markedly dilated and thickened; the lower pelvis was only slightly increased in size but showed moderate fibrosis. The patient's convalescence was uneventful, and 2 months later, she was in good health.

Case 7. (A193971.) Mrs. C. D., age 34, came to the Clinic complaining of attacks of right abdominal

colic associated with chills, fever, and pyuria, beginning 8 years before, after childbirth, and lasting about 2 years. During the last 6 years pain had been intermittent in the upper right abdominal quadrant. Her gall bladder had been explored, but it had been found normal.

On physical examination a tender mass was palpated in the upper right quadrant. The roentgenogram and examination of the urine were negative. Cystoscopic examination revealed a normal bladder with normal appearing urine from both sides. The phenolsulphonephthalein return was 12.5 per cent from the left ureter in 15 minutes and 7.5 per cent from the right. A pyelogram of the right kidney revealed duplication of the pelvis and ureter with hydronephrosis and hydro-ureter. A diagnosis of right hydronephrosis in a double kidney was made.

At operation the right kidney was removed. A double pelvis and ureter were found; the upper ureter was markedly dilated. Both ureters were excised about 8 centimeters from the kidney, but the point of bifurcation was not found. The upper part of the kidney was almost completely destroyed, the lower contained little normal tissue and much interstitial fibrosis. The patient recovered from the operation readily.

Case 8. (A234432.) Mr. R. R. P., age 46, came to the Clinic because of intermittent periods of hæmaturia of 5 years' duration. For several months, he had had moderate pain in his left knee and ankle and a sense of discomfort in the region of the right kidney.

The physical examination was negative; the urine contained pus cells and blood. A roentgenogram contained multiple shadows in the right kidney area. Cystoscopic examination revealed a normal bladder. The urine from the right ureter contained a small amount of pus; that from the left was normal. The phenolsulphonephthalein return was 10 per cent from the right ureter in 15 minutes, and 12 per cent from the left. A pyelogram of the right kidney revealed duplication of the pelvis and ureter; the calices of the lower pelvis were dilated, which obscured the shadows seen in the original roentgenogram. A diagnosis of stones in a right double kidney was made.

At operation a double kidney almost completely divided by a lateral sulcus was found. The ureters draining the two pelves united about 3 centimeters below the lower pelvis. A small papillary cystadenoma was enucleated from the renal cortex and two small stones were removed from the lower pelvis.

Six months later, the patient returned to the Clinic. He had gained 15 pounds and had no urinary complaint, but he had a constant dull pain in his lower right quadrant. The roentgenogram contained a shadow in the region of the right kidney. Cystoscopy and pyelography located the stone in the lower pelvis. Both the upper and lower pelves showed moderate inflammatory dilatation.

At the second operation the right kidney was removed. Both pelves contained evidences of chronic infection and the lower ureter was dilated and thickened. Many fine cortical abscesses were scattered throughout both portions of the kidney (Fig. 11). Three years later, the patient was perfectly well although at times he had slight pain in the lower abdomen.

Fig. 11. Case 8. (A234432.) Double kidney, the infected lower segment, containing many cortical abscesses. The upper and lower portions are separated from one another by a deep sulcus.

Case 9. (A234433.) Mr. V. K., age 45, came to the Clinic on account of intermittent attacks of renal colic and almost constant dull, heavy pain in the left lower abdomen during the last seven years.

The general examination was negative. The urine contained a moderate amount of pus and red blood cells. The roentgenogram contained a shadow opposite the third lumbar vertebra. At cystoscopic examination clear spurts of urine were seen coming from both ureters. The differential functional test was 15 per cent return of the dye from the right side and 7 per cent from the left. A left pyelogram revealed a dilated ureter and a large hydronephrosis, which obscured the shadow opposite the third lumbar vertebra. A diagnosis of left hydronephrosis with stone was made.

At operation a large kidney with two moderately dilated pelves was found on the left. The upper and larger was drained by a greatly distended ureter. Both left ureters opened into a markedly sacculated pouch, which extended from the junction of the

Fig. 12. (Case 9-A308206.) Primary division of the ureter or pelvis situated away from the kidney and attached to it by elongated ureteral divisions. Each division drains a separate renal segment.

meters below the upper pelvis toward the bladder for a distance of 7 centimeters. A small stone was found impacted in the lower end of the sacculation, blocking the common outlet (Figs. 12 and 13). Two years later, the patient was in good health having had no further trouble.

Case 10. (A376487.) Miss M. J., age 32, came to the Clinic because of attacks of dull pain referred to the left abdominal quadrant and radiating to the lower quadrant; she had had attacks for 4 years, a severe one a year and a half before. Recently, the attacks had occurred every 8 to 10 days, or they lasted from 12 to 24 hours and were followed by a dull ache in the anterior part of the abdomen, often with flatulence and distress over the entire lower abdomen. Frequency was moderate. It will be noted that the pain was entirely anterior and not at all suggestive of renal involvement.

The urinalysis was practically negative. The phenolsulphonephthalein return was 50 per cent in 2 hours and 15 minutes. Roentgenograms of the urinary tract, colon, and stomach were negative. A cystoscopic examination was made for the purpose of identifying the pain. Both ureteral orifices were normal in location and appearance, and secretion of the right kidney was normal. A catheter introduced into the left ureter did not meet obstruction. One hundred ten cubic centimeters of residual urine was withdrawn from the renal pelvis, and there was only a faint trace of phenolsulphonephthalein in 15 minutes. A pyelogram of the left kidney showed definite dilatation of pelvis and calices. The dilatation, however, did not appear sufficiently marked to account for the large amount of residual urine found in the renal pelvis, which we were at a loss to explain. A diagnosis of left hydronephrosis was evident.

At operation the renal pelvis was found to be markedly dilated. The kidney tissue was evidently largely destroyed, and a nephrectomy was performed. On section of the kidney two definite segments of the renal pelvis were found, the upper of which was confined within the kidney proper; the dilated portion visible outside the kidney was directly related to the lower segment only. The two segments of the pelvis were separated by a definite band of atrophied renal tissue and were connected by a narrow isthmus which corresponded to two adjacent calices which had coalesced. The calices were markedly dilated in both pelves. Only a narrow rim of cortical tissue remained which appeared to be atrophic. The patient had a normal convalescence and two months later was in good health.

NEPHRECTOMY FOR TUBERCULOSIS: SIX CASES

Case 11. (A81845.) Mr. R. F. R., age 37, came to the Clinic because of frequency, dysuria, and occasional attacks of moderate pain in the left renal area for the last 2 years. He had had both testicles removed for tuberculosis 7 years before.

The left abdominal wall was rigid. The roentgenogram was negative. The urine contained pus cells and bacilli of tuberculosis. Cystoscopic examination revealed only slight cystitis. Normal urine was obtained from the right ureter; the opening of the left would not admit a catheter; the site was marked by a small area of granulation. A diagnosis of occluded left renal tuberculosis was made.

At operation a double kidney about twice the normal size was removed. There were two pelves and two ureters; both ureters were dilated and thickened. There was a well-defined sulcus dividing the upper portion of the kidney from the lower. Bifurcation of the ureters was not found. The lower kidney and pelvis composed only about one-fourth of the entire mass. The pelvis was thickened and contracted and the surrounding renal tissue was almost completely destroyed by an extensive tuberculous caseation. A band of solid renal tissue 3 centimeters wide separated the two pelves. The upper pelvis was slightly dilated; the cortex of this portion contained a few small areas of tuberculosis. Six months later, the patient was in good health.

Case 12. (A219577.) Mrs. H. B., age 25 years, came to the Clinic complaining of a dull ache in her back of 2 years' duration. Two weeks before, she had noticed blood in the urine; this had been in-

Fig. 13. (Case 9-A308206.) Section of double kidney showing extrarenal pelvis blocked at its outlet by a stone.

creasing. Several days after the onset of the bleeding she had developed a severe cramp-like pain in the region of the left kidney.

At examination the left side of the abdomen was found to be tender; the glands in the cervical region were enlarged. The urine contained both pus and blood but no bacilli of tuberculosis. The roentgenogram showed several small shadows in the region of the left kidney. Cystoscopic examination revealed a normal bladder. The urine from the left ureter contained blood; that from the right was normal. The phenolsulphonephthalein return was 12 per cent from the right ureter in 15 minutes and 10 per cent from the left. A left pyelogram revealed duplication of the pelvis; the shadows observed in the original roentgenogram were included in the lower pelvis where there was also evidence of tissue necrosis. A diagnosis of left double kidney with infection and stones in the lower pelvis was made.

A left nephrectomy was performed. The two pelves of a double kidney were found to be separated from one another by a heavy band of renal tissue; a deep groove externally marked the division. The lower pelvis was small and contracted and showed extensive tuberculous caseation; a thickened œdematous ureter drained it. The shadows seen in the roentgenogram and thought to be stones were caused by calcareous deposits in the centers of these areas of tuberculous caseation. The upper, smaller, and apparently normal portion of the kidney emptied into the lower portion through a narrow, tapering connection. The patient recovered from the operation and is now well.

Case 15, [illegible]. Mr. C. A. L[illegible] was sent to the Clinic because of moderate pain in the lower abdomen of 2 years' duration. Appendectomy had been performed without relief. During the last year he had had moderate pain in the left loin, especially

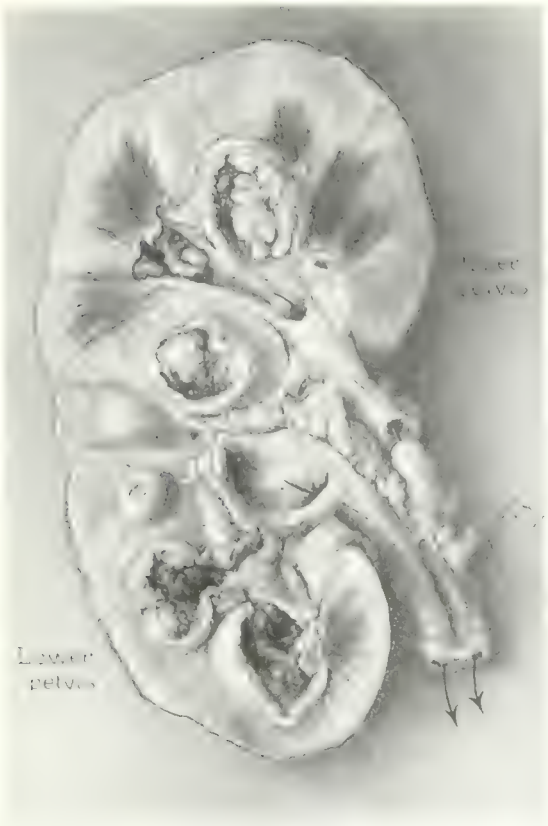

Fig. 14. (Case 13-A299002.) Extensive caseating tuberculosis involving both segments of a double kidney.

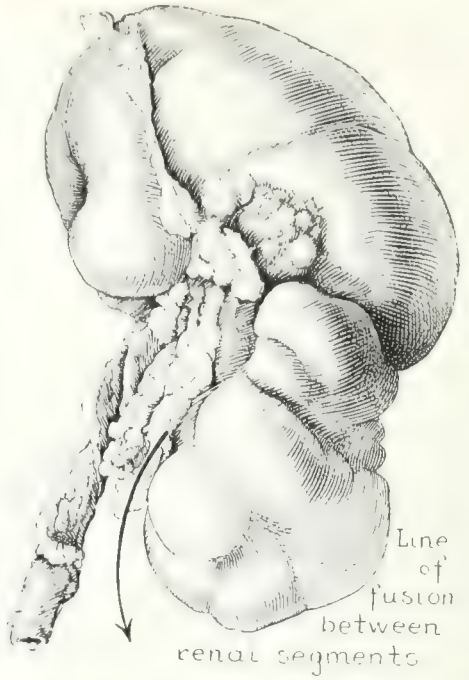

Fig. 15. (Case 10-A377105.) Extensive tuberculosis of the lower segment of a double kidney. The two segments are almost completely separated from one another. The upper segment contains a few scattered tubercles and giant cells.

noticeable after exertion or when riding horseback. He had not had urinary symptoms, although for several months there had been pus in the urine. Ten days before, while riding horseback, he had bruised his left testicle.

The physical examination was negative except for the finding of an enlarged nodular urine-stained epididymis. The urine contained a large amount of pus and bacilli of tuberculosis. Cystoscopic examination revealed a moderate degree of cystitis; clear urine was obtained from the right ureter and cloudy from the left. The phenolsulphonephthalein return was 22 per cent from the right ureter in 15 minutes and 2 per cent from the left. A pyelogram of the left kidney revealed a few scattered areas of dilated calices and evidence of tissue necrosis. A diagnosis of left renal tuberculosis was made.

At operation a kidney twice the normal size was removed. Two thickened dilated ureters drained separate pelves and joined each other about 2 centimeters below the lower pelvis. On section extensive caseating tuberculosis of both sections of the kidney was found. The pelves were of about equal size and were divided by a band of parenchymatous tissue 1 centimeter wide (Fig. 14). Three weeks later, the left epididymis was removed and found to be tuberculous. The patient's convalescence was uneventful and he left the hospital in good condition.

Case 14. (A339574.) Mrs. H. E. C., age 50, came to the Clinic because of frequency and dysuria and occasional lower abdominal pain, of 3 years' duration.

The physical examination was negative. The urine contained a moderate amount of pus and bacilli of tuberculosis. Roentgenogram of the kidneys showed a few calcified flakes in the right renal area. On cystoscopic examination ureteral cystitis of moderate degree was found. The inner of the two ureteral openings on the left side was apparently normal; the upper was contracted and eroded and emitted only an occasional spurt of turbid urine. The ureter and kidney on the right were both normal. On catheterization of the two left ureters a stricture was encountered in the outer ureter 10 centimeters from the opening. The phenolsulphonephthalein return was 6 per cent from the inner ureter in 15 minutes and 1 per cent from the outer. Pyelograms of the left kidney revealed a double pelvis, the upper connected with the lower. The lower pelvis injected through the outer catheter pos-

sessed only a few dilated calices and a distended ureter. A diagnosis of duplication of the left kidney with tuberculosis of the lower segment was made.

At operation a long, thin, tapering kidney with a definite line of division on the anterior surface was removed. There were two pelves and two ureters. The segment between the two pelves showed extensive tuberculous caseation which extended to, and almost completely destroyed, the lower pelvis. The upper renal segment was normal in appearance but a histological examination revealed few isolated tubercles in the renal cortex. The patient convalesced normally and, 2 years later, was perfectly well.

Case 15. (A342668.) Mrs. B. M., age 30, came to the Clinic with urinary frequency at intervals, which had begun 11 years before, and pain referred to the neck of the bladder. For 2 years, the patient had had occasional dull pain referred to the left kidney area, but this had improved during the past year. She had had occasional spells of epigastric distress. The general condition was suggestive of neurosis. There was no loss in weight.

General physical examination, including roentgenograms of the urinary tract and chest, was negative. A specimen of urine catheterized from the bladder contained only 20 pus cells in a high-power field of the microscope. The sediment was stained for the bacilli of tuberculosis and was negative. The phenolsulphonephthalein return was 50 per cent in 2 hours and 15 minutes. Cystoscopic examination revealed a bladder with normal capacity, and save for a few areas of slight inflammation, comparatively normal. The left ureteral opening was slightly eroded, with an inflamed area of mucosa and granulation tissue around it. Obstruction was met by the catheter introduced into the left ureter at a distance of 2 centimeters from the opening, but at a subsequent examination the catheter passed into the ureter to a normal length without obstruction. Catheterized specimens obtained at the second examination from both right and left kidneys were normal. A pyelogram made of the left side showed a very small pelvis with abbreviated calices. The ureter was but slightly dilated for a distance of several centimeters. Below this it was markedly dilated. A diagnosis was made of duplication of the pelvis and ureter with destruction of the lower pelvis (?), atrophic pyelonephritis (?), and tuberculosis of the left kidney (?).

At operation a double kidney with duplication of the pelvis and ureter was apparent. The lower pole of the kidney was atrophic and cicatricial. The two parts of the kidney seemed quite distinct, with a definite zone of demarcation. It was thought at first that the lower portion was atrophic as the result of cicatricial pyelonephritis, since no definite evidence of tuberculosis had so far been discovered. The lower portion was then resected without much difficulty. On microscopic section of the renal tissue at the line of excision, areas were found containing atypical tubercles and giant cells. The remaining portion of the kidney was then removed. The patient had an uneventful convalescence and left the hospital in good condition.

Case 16. (A[illegible].) Mr. [illegible] came to the Clinic with symptoms beginning 15 years before with slight urinary frequency at irregular intervals. Seven years before, he had had several attacks of dysuria with increased frequency and very cloudy urine which had continued over a period of several months. Since then he had had diminished urinary disturbance with soreness and dull ache in the urethra. Five years before, he had noticed hard painless nodules in the left epididymis, and 2 years before the same condition in the right epididymis. One year before, he had had slight hæmaturia.

The general examination was negative save for moderate chronic bilateral tuberculous epididymitis. The left lobe of the prostate was nodular. Roentgenograms of the urinary tract were negative. A moderate amount of pus was found in the urine, and, after repeated sterile cultures, tubercle bacilli were found. The phenolsulphonephthalein return was 50 per cent in two hours. Cystoscopic examination revealed a slight cystitis. The urine from both ureters appeared to be normal. A catheterized specimen of urine from the right kidney was normal; that from the left contained an abnormal proportion of pus. The differential phenolsulphonephthalein test showed 20 per cent to be coming from the left kidney, and 7 per cent from the right in 15 minutes. A pyelogram of the left side showed marked dilatation of the ureter; the pelvis and calices were abnormally small. A diagnosis was made of tuberculosis of the left kidney.

At operation a double kidney with tuberculosis in the lower segment was found. The upper portion of the kidney appeared to be normal, while the lower segment was very evidently diseased and functionless (Fig. 15). Since the bacilli of tuberculosis had been found in the urine, a complete nephrectomy was performed. On section of the kidney a sharp line of demarcation between the healthy and diseased portions was noted. On microscopic examination of the apparently normal tissues, however, several areas of encroaching foci of tuberculosis were observed. The patient had a normal convalescence and left the hospital in good condition.

NEPHRECTOMY FOR ATROPHIC PYELONEPHRITIS: THREE CASES

Case 17. (A188815.) Mr. H. K. E., age 26, came to the Clinic because of pain in the left renal area of 16 years' duration. The pain had been most noticeable during micturition. During the last years, he had had several attacks of left renal colic accompanied by frequency and pyuria.

Physical examination was negative except for the finding of tenderness in the upper left quadrant of the abdomen. The urine contained pus cells and blood; the roentgenogram was negative. Cystoscopic examination revealed diffuse cystitis with pus cells and blood coming from [illegible]

The phenolsulphonephthalein return was 20 per cent from the right ureter in 15 minutes and 8 per cent from the left. A left pyelogram revealed inflammatory changes of the renal pelvis. A diagnosis of chronic pyelonephritis with atrophy was made.

At operation a small contracted kidney was removed. Two calices and two ureters were present; both ureters were markedly thickened. The kidney was divided by a deep sulcus into two distinct parts. The upper portion was almost completely destroyed; the surfaces of the dilated calices and pelves were necrosed. The pelvis of the lower half was thickened and contracted and the renal tissue had been replaced almost completely by fat and fibrous tissue. Atrophy of all the renal tissue was practically complete. The patient made a rapid recovery after operation and, one year later, was perfectly well.

CASE 18. (A223011.) Mrs. T. L. M., age 47, came to the Clinic complaining of attacks of urinary frequency of 5 years' duration. Occasionally she had felt dull pain in the region of the left kidney. Three years before, she had been told that the left kidney was infected; the left renal pelvis had been lavaged a number of times.

The physical examination was negative except for the finding of infected tonsils. The urine contained a small amount of pus and blood. On cystoscopic examination a mild cystitis was found; the urine from the right ureter was normal, that from the left contained pus cells. The phenolsulphonephthalein return was 25 per cent from the right ureter in 15 minutes and 1 per cent from the left. A pyelogram of the left kidney revealed a small contracted pelvis. A diagnosis of left atrophic pyelonephritis was made.

At operation a contracted septic kidney about one-half normal size, with two ureters, was removed. A line of division indented the anterior surface of the kidney between the upper and lower portions. Two distinct pelves, thickened and contracted, were separated by a division of fibrous renal tissue. The renal tissue in the lower segment was almost completely destroyed by fibrosis. The patient made a prompt recovery after the operation and was well 4 years later.

CASE 19. (A308248.) Mrs. C. I. W., age 30, came to the Clinic because of frequency and dysuria. For 6 months, she had been feeling listless and run down. For 6 weeks, she had had severe pain in the left lumbar region radiating to the left groin with spells of frequency and dysuria and, on several occasions, chills and fever.

At physical examination an area in the left lumbar region was found to be tender. The temperature was 102°. The urine contained a large amount of pus and the phenolsulphonephthalein return was normal. The roentgenogram contained an indefinite shadow in the area of the left kidney. At cystoscopic examination clear urine was seen coming from both sides. Phenolsulphonephthalein return in 15 minutes was 17 per cent from the right ureter and 4 per cent from the left. A pyelogram of the left kidney revealed a small contracted pelvis. On account of the high temperature and tenderness over the left kidney a diagnosis of septic left kidney with atrophy was made.

At operation a kidney, normal in size, with two pelves and ureters was removed. The lower half of the kidney was studded with many small cortical abscesses. The pelvis draining this portion was dilated and almost completely filled with fat, which would account for the contracted appearance of the pyelogram. A slight sulcus on the anterior surface of the kidney divided the two portions. The ureteral juncture was not seen. The patient recovered readily from the operation and, 20 months later, was perfectly well.

SUMMARY

One hundred forty-four patients with duplication of the renal pelvis and ureter have been observed at the Mayo Clinic. The incidence of aberrant and bilateral duplications of ureters and pelves reported in the literature is relatively too high owing to the tendency to report the more unusual cases. Of the patients in this series the duplication was unilateral in 135 (94 per cent) and bilateral in 9 (6 per cent). Of the 135 patients with unilateral duplication 36 (25 per cent) had complete duplication and 99 (68.7 per cent) had incomplete duplication. Of the 9 patients with bilateral duplications 8 had complete duplication and 1 had incomplete.

Duplication may vary from duplication confined to the renal pelvis to duplicate pelves with separate ureters opening into the bladder. The pelves are generally unequal in size, the upper being the smaller, and are separated by a bridge of normal renal cortex of variable extent. When an unusually small renal pelvis is outlined in the pyelogram, the possibility of duplication should be suspected.

Complete duplication will be discovered more often if a careful search is routinely made for anomaly at the time of cystoscopic inspection. In cases of partial duplication the diagnosis is made only by means of a pyelo-ureterogram.

The lower segment is primarily involved more often than the upper.

Hydronephrosis is the most common pathological complication and is due to ureteral obstruction, generally in the region of the juncture of the two ureters in cases of incomplete duplication.

In tuberculosis of double kidneys gross evidence of the disease is generally confined to one segment, usually the lower; but in all cases histological examination reveals tubercles in the intervening renal tissue and extending into the remaining segment.

Occasionally when only one pelvis is outlined by the pyelogram, its unusual shape and contour may be misconstrued with pathological changes occurring in single kidneys, such as atrophic pyelonephritis.

In the series of 144 cases, the histories of 19 of which are here reported, 30 patients were treated surgically, 24 patients had definite pathological conditions which did not require surgical treatment, and in 27 evidence of disease was doubtful. Only 61 (42 per cent) of the patients were without pathological complications and the anomaly was discovered in the examination for other conditions.

Fifteen of the 30 patients operated on submitted to primary nephrectomies and 4 to heminephrectomies; 2 of these later required complete nephrectomy. Six pyelolithotomies and three ureterolithotomies were performed. In one patient hydronephrosis was relieved by the cutting of an aberrant vessel and in another symptoms were relieved by the ligation of an aberrant ureter from the upper pole of a double kidney.

In the treatment of pathological complications in a double kidney the indication for heminephrectomy is limited to but a few favorable cases. The possibility of infection extending to the remaining half of the [illegible] kidney, which may necessitate subsequent complete nephrectomy, must be considered.

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INFECTION OF THE SIGMOID AND LATERAL SINUS

REPORT OF A SERIES OF NINETEEN CASES[1]

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Extension of infection from the middle ear and mastoid process to the sigmoid and lateral sinus is always to be dreaded. Although a certain percentage of patients thus affected recover, the majority will succumb if left to their own defensive mechanism. If timely operative interference is instituted, the prognosis is relatively good. The recorded experience of previous observers has been helpful in the care of such patients, and I am reporting these 19 cases for the purpose of adding our clinical experience to the data on the subject.

The 19 patients were observed at the Mayo Clinic during the past 5 years in a series of more than 500 cases of mastoid disease in which operation was performed and more than 150,000 miscellaneous cases examined in the ear, nose, and throat section. The patients have been divided for discussion into four groups:

Group 1. Patients with involvement of the sigmoid sinus by phlebitis, or non-obliterating thrombosis;

Group 2. Patients with obliterating thrombosis;

Group 3. Patients who died without submitting to operation;

Group 4. Patients who died and in whom the disease was not recognized clinically.

GROUP 1

CASE 1. (A215641.) C. S., a boy, age 11, was examined December 2, 1917, because of pain in the left ear and severe illness. He had had earache and discharge at the age of 1½ years, and since then occasionally earache without discharge. The present trouble began 2 weeks before with earache on the left, followed in a few days by spontaneous rupture with thick discharge and some pain. He had had fever but there was no history of chills. He had vomited three times, and was very weak. No treatment had been given except "fever medicine" and cold applications.

The boy appeared very ill, pasty, and apathetic. His temperature was 102°. The tonsils and adenoids were enlarged and infected. A rhinitis was resolving. Knee jerks were present. The left cervical glands were large and tender. The right ear appeared normal; the left vestibule was eroded by purulent discharge from the canal. Pulsation and drooping were marked. The mastoid was not especially tender on deep pressure nor was there pain on motion of the auricle. Hearing test revealed combined deafness. The boy could hear a conversational voice on the left. The leucocyte count ranged from 28,000 to 31,000. A subacute nephritis was found. Diagnosis was made of perisinus abscess with sinus involvement.

December 2, a complete mastoidectomy (complete exenteration of the mastoid cells) was performed on the left side with ablation of the sigmoid sinus. The degree of sclerosis encountered was unusual for so young a patient; bleeding was severe. The mastoid was of the small-cell variety in which the sigmoid sinus lay well back and very deep. The bone over the sinus appeared healthy, but on exposure of the sinus pus welled up. When the sinus was uncovered extensively from the bulb, more evidence of the disease was found. Both ends of the sinus bled freely after probing. A small epidural abscess over the tegmen was opened. The child was in fair condition when he left the operating room (Fig. 1).

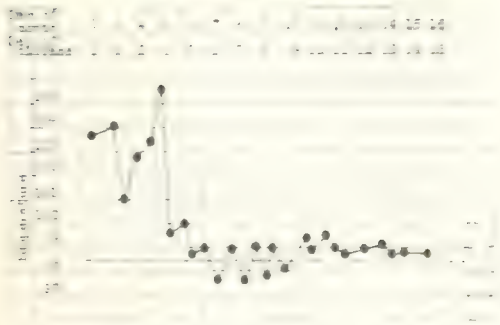
CASE 2. (A221818.) L. G., a girl, age 9, was examined February 11, 1918. Following influenza both ears had ruptured spontaneously and discharged for 4 weeks. The right ear, with a swelling behind it, had been the more painful. There was no history of chills, but each afternoon the patient had had fever. The "pasty look" had appeared within the last week.

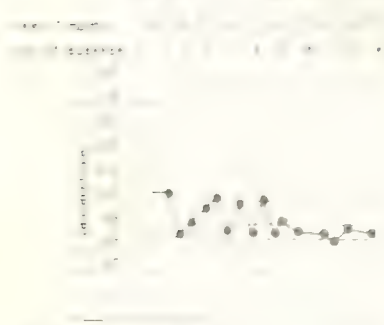
The patient had the facies of sepsis and appeared ill. The tonsils were enlarged and red. There was a definite cervical adenitis. The right mastoid region was swollen; redness, fluctuation, and tenderness were more marked over the tip and emissary vein. The canal wall drooped definitely. One discrete gland over the left mastoid was noted. The membrane was full, the discharge thick. Perforation had occurred in the posterior inferior quadrant. The urine contained casts and blood cells. The leucocyte count was 14,800. A diagnosis was made of suppurative otitis media, with mastoiditis and sinus involvement.

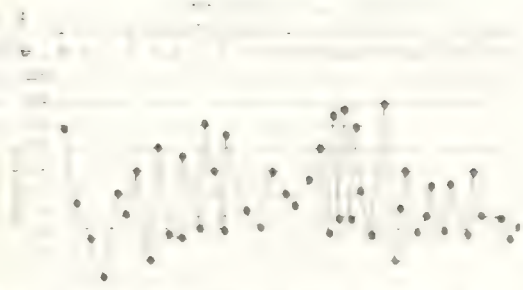
February 12, a subperiosteal abscess was opened. The mastoid cells were filled with infected granulation and pus. The knee of the sinus was covered with granulation; the wall, which felt board-like, was opened and a mural clot encountered. The sinus was ablated (Fig. 2).

CASE 3. (A229133.) Mr. L. M., age 18, came to the Clinic April 22, 1918, because of discharge from

[1] Presented before the Eye, Ear, Nose and Throat Society, Kansas City, February 17, 1919.







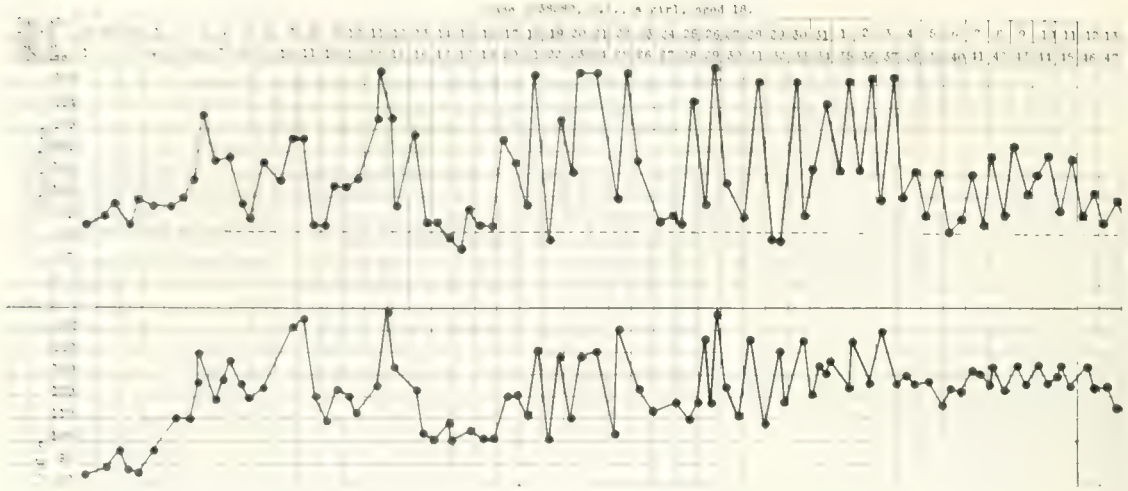


Fig. 4. Case 4. Postoperative course uneventful for 5 days. Sixth day: severe spontaneous hæmorrhage from sinus; fever 103° with chill; leucocytes 34,600; blood culture negative. Seventh day: sinus ablated. Fourteenth day: fever 105.3°; blood culture negative; toxic nephritis; patient very ill; sinus bled at dressing; leucocytes 14,000. Twentieth day: somewhat improved; fever 102.8° with chill; blood picture the same; urine improved. Twenty-first day: internal jugular ligated. Twenty-eighth day: decidedly worse condition; failing fast; changed to a room with more sunlight. Twenty-ninth day: blood transfusion, citrate method, 500 cubic centimeters. Thirtieth day: improved. Thirty-fourth day: blood transfusion, 500 cubic centimeters. Thirty-seventh day: intravenous injection of 75 cubic centimeters of serum for foreign protein reaction. Fortieth day: injection of 75 cubic centimeters of serum. A decided change for the better, and gradual improvement took place. The radical cavity healed kindly. The patient is a nurse in training.

The severity of the patient's illness cannot adequately be described. In retrospect, it was necessary to operate on this patient in the manner followed in order to remove the disease. The spontaneous hæmorrhage from the sinus was unforeseen, although it was remarked at the time of the operation that something might be expected to happen to an uncovered sinus wall of such character, and the usual precautions in the postoperative dressings were carried out. The sloughing was very extensive and the bleeding difficult to control. It might be said that the vein should have been tied at the time the sinus was ablated; after the vein had been tied, however, there was little or no effect. On culture the blood and spinal fluid were repeatedly negative. Blood transfusion and forced diet were used as supportive measures. As the patient's general condition grew worse the leucocyte count decreased. The serum was given for the foreign protein reaction; the specificity of the infection was never determined. The nephritis cleared decidedly as the general condition improved. It is interesting to note that the pulse curve followed the temperature curve.

Case 5. (A113562.) C. E., a boy, age 12, was brought to the Clinic June 18, 1920, because of discharge from both ears. The onset of the trouble began 5 weeks before with pain in the right ear following a severe "cold." Paracentesis had been performed 2 days after the onset of pain with only partial relief. The left ear had ruptured spontaneously with complete relief from pain. One week and 2 weeks respectively after the onset, the boy had had chills and a rise in temperature. An abscess had developed in the right leg accompanied by chills and a temperature of 104°.

The patient was pale and presented septic facies. The canals of both ears contained a small amount of clear, odorless serum. The left ear seemed the more involved. The drums were somewhat reddened, but not bulging, and had small perforations in the posterior inferior quadrants with pulsating thin discharge. There was no drooping of the posterior superior canal wall on either side. Examination of the mastoids was negative but definite tenderness over the emissary vein was present on the left. An abscess on the ankle was draining. Examination of the fundi was negative. The temperature was 101°, and the pulse 118. The blood culture showed streptococcus hæmolyticus in 8 hours' time. The history of chills, the metastasis, the appearance of the patient, the clinical course, and the leucopænia suggested sinus involvement. A diagnosis was made of suppurative otitis media with mastoiditis, sinus phlebitis, and metastasis.

June 19, a complete mastoidectomy was performed on the left side and the sinus explored. The

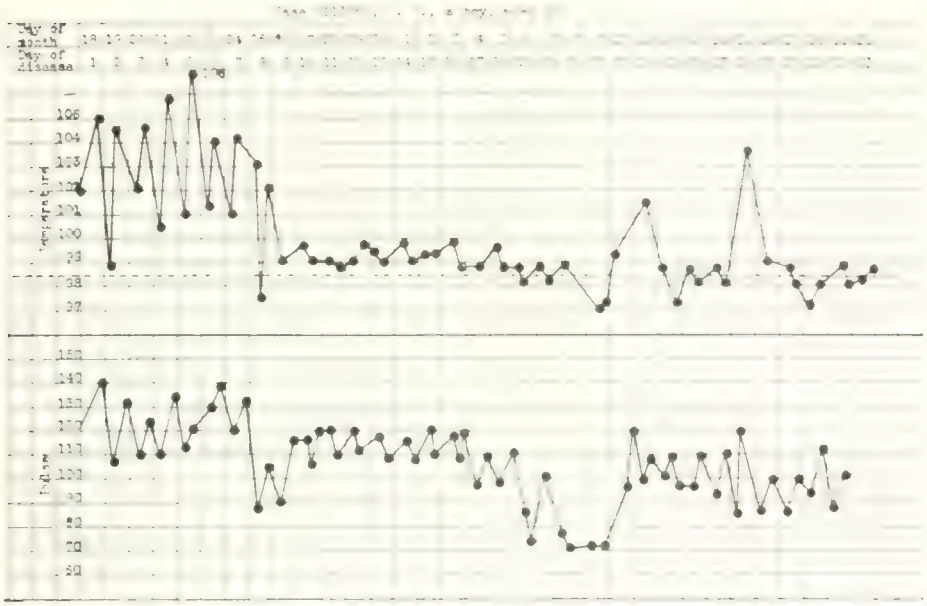


Fig. 5. Case 5. Postoperative course: Leucocytes 6,800. Bloodculture, virulent hæmolytic streptococcus in 12 hours. Definite general improvement for two days. Fourth day: slight swelling of discs; ankle cared for in orthopedic section. Fifth day: temperature rose to 106° following the dressing; patient chilly, restless at night; hæmoglobin 50 per cent. Sixth day: internal jugular vein ligated; blood transfusion; citrate method, Group II, 500 cubic centimeters. Eighth day: much improved, blood culture negative. Ninth day: signs of pleural effusion, gradual improvement until the twenty-third day. Fever apparently due to food as a number of patients had the same reaction. Twentieth day: nothing to account for the fever. Thirty-third day: dismissed to out-patient service; has been seen at intervals since and is in excellent condition.

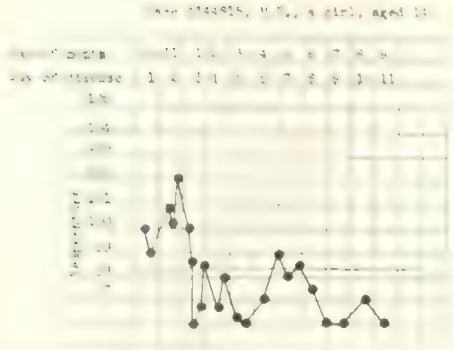
mastoid was of the hæmorrhagic type. The exposed sinus appeared normal and bled freely. Examination of the upper end for adhesions revealed a drop of pus coming from under the table. Exploration toward the torcular herophili brought to light definite phlebitis. The sinus was slit well back, allowed to bleed freely, and then packed. The patient was in good condition on leaving the operating room. The pathological process in the sinus was sufficient cause for the symptoms.

June 23, the jugular vein was ligated and sectioned at the level of the facial nerve; it was approached as in the ligation of thyroid vessels. The facial and lingual veins were tied off. The internal jugular was found to be thrombosed down to this region. Three hundred seventy-five cubic centimeters of blood was transfused without incident the same afternoon, the mother being the donor (Fig. 5).

It was necessary to choose the mastoid to be operated on. There was little difference in the appearance of the ears. The left was slightly more tender over the emissary vein and there were a few palpable glands in the left upper cervical region. The patient was so sick that the internist advised against operation, particularly in the presence of such virulent infection of the blood and the leucopænia. Operation was probably not necessary on the mastoid, except to check extension of the disease. The area of phlebitis was not in the mastoid itself, but posterior to it, and toward the torcular herophili. The ligation of the jugular vein and the transfusion had a beneficial effect, causing a definite change in the patient's general appearance. In this case also, the pulse curve follows the temperature curve.

The method of approach to the jugular vein in this case was not so satisfactory as that of incision along the anterior belly of the sternomastoid muscle.

Case 6. (A344815.) M. B., a girl, age 14, was examined in the Clinic, December 30, 1920. She complained chiefly of discharge from the right ear with slight swelling in the region of the mastoid; she had had [illegible] for [illegible] days. Twenty days before, she had had a very severe sore throat, and both ears had ached. Three days later both ears



Postoperative course: Uneventful with the exception of choked discs on the twentieth day after operation. These gradually diminished. The patient was dismissed on the thirtieth day.

had begun to discharge and had continued for 2 days. About 10 days later, severe pain had occurred behind the right ear, followed by swelling, discharge, and increased temperature. The right side of the head was very tender to pressure and deafness was quite marked in the right ear.

Examination of the nasopharynx revealed a pad of adenoids; the right ear drum was red and bulging. The posterior superior canal wall drooped, but perforation and discharge were not visible. There was marked tenderness behind the auricle region of the tip. Hearing tests disclosed right combined deafness. A roentgenogram of the right mastoid showed some cloudiness. The patient had acute bronchitis; nevertheless, the acute condition of the mastoid made operation imperative. A diagnosis was made of suppurative otitis media with right subacute mastoiditis and sinus phlebitis.

December 31, a complete mastoidectomy was performed with exploration of the right sinus. The mastoid was quite unusual. On uncovering the cortex, it was found that mastoid cells had perforated over the posterior portion of the tip, the cells of which were extensively involved and the trabeculæ broken down. In the region of Trautmann's triangle, the probe dropped into a cavity which proved to be an exposed sinus. The antrum was contracted; the aditus was very small and situated well posteriorly. The sinus was exposed extensively toward the bulb and back over the knee until normal dura was revealed. After tamponing under the bone edges the sinus was incised and a definite mural thrombus encountered; this was sufficient to account for all the patient's symptoms. Bleeding was free from both ends. Paracentesis was performed. One pack was placed over the bulb, one over the knee end, and one in the mastoid cavity. A wick was placed in the ear (Fig. 6).

The vein might have been ligated at the time of the mastoid operation, but with the patient in fairly good general condition it was felt that the operation could be delayed to await developments. Although obliterating thrombus was not found, choked discs occurred.

Case 7. (A173975.) D. W., a boy, age 8, was brought to the Clinic January 11, 1921, because of discharge from the left ear, of 8 weeks' duration. Chills, fever of 104.5°, frontal headache, and dizziness had developed the day before. Only at the onset of the ear trouble had the mastoid been tender.

Examination revealed subacute otitis media on the left with sinus phlebitis so severe as to demand immediate surgical attention. The leucocyte count was 40,000. The patient was very restless and irrational with only periods of mental clarity. There was ptosis on the right, and discoloration of both lids. Extra-ocular movements were not involved. The mediums were clear. The fundi were negative. All positive findings had appeared in the last 12 hours.

January 31, complete left mastoidectomy was performed. On uncovering the mastoid the whole cortex was found to be bleeding. The mastoid was of the small-cell type; a large amount of pus welled up from below the knee of the sinus which lay well forward and had been exposed by the disease process. The zygomatic cells were filled everywhere with infected granulations. The distal and proximal ends of the sinus were packed off and the sinus was excised with free bleeding from both ends. Because of the findings it was thought that the perisinus abscess was the cause of the symptoms. It was considered necessary to await further developments before deciding whether or not a jugular ligation should be performed, as the infection might be direct into the bulb. The patient stood the operation well (Fig. 7).

Case 8. (A359149.) Mrs. D., age 41, was examined in the Clinic May 25, 1921. Her left ear had been painful and had discharged for 5 months; the swelling behind the ear had been variable; fever had persisted during the first 2 weeks. She had had constant pain on the left radiating over the occipital and parietal regions as far as the middle line. Spontaneous rupture had occurred the second day. Occasional tinnitus had been noted. The canal had been cleansed. Tenderness over the mastoid had developed 1 week later and remained. The patient's general health had remained good. There was a history of repeated attacks of tonsillitis.

Examination revealed profuse discharge from the left ear, and marked drooping of the wall of the superior canal. The canal refilled immediately after cleaning. There was no mastoid tenderness except over the emissary vein. The pus was too profuse to be accounted for on the basis of middle ear trouble alone. It was felt that the mastoid condition was surgical and that the lateral or sigmoid sinus was involved. A diagnosis was made of left mastoiditis, with perisinus abscess.

May 27, when the cortex was uncovered, many bleeding points appeared and when the outer table was removed a large quantity of pus welled up, pulsat-

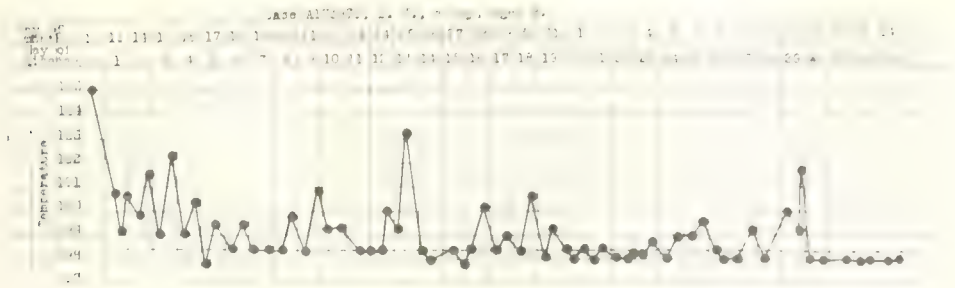


Fig. 7. Case 7. Postoperative course: Condition good after operation. Patient in Group III grouping. Ptosis of the right eyelid, but discoloration and œdema lessening. Fourth day: Wound clean; sinus bled on removal of middle pack; repacked with vaselined pack. [illegible] tion. Ninth day: slight rise in temperature following removal of all packs. Temperature s[illegible] rose to 103.6°, painless otitis media, suppurative right side. Tenth day: temperature normal. Eleventh day: eye examination showed the veins of retina dilated, engorged, and tortu[illegible] discs not choked, only slightly swollen; leucocytes 15,000, not accounted for; slight rise in temperature; watched for signs of sinus involvement; pain in the right ear; membrane tympanum full, dull red, but no pain at examination; paracentesis. Sixteenth day: slight rise in temperature; no pulsation in sinus; wound in good condition; both ear canals filled with mucopus; the child had a slight rise in temperature intermittently for the remainder of his stay in the hospital; he gradually improved and was dismissed to out-patient service on the thirtieth day.

ing under pressure. Removal of the cortex revealed a very extensive cavity, extending over the temperosphenoidal lobe, the cerebellum, and the knee of the sinus, which were uncovered to a fairly healthy appearing dura. Pachymeningitis was definite. The sinus felt so cord-like that it was opened and an organized thrombosis not filling the lumen was found. Free bleeding occurred at both ends. One pack was placed over each end of the sinus and one in the mastoid cavity. Paracentesis was performed (Fig. 8).

SUMMARY OF CASES IN GROUP I

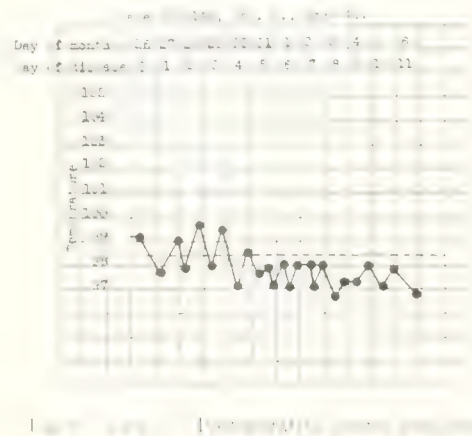
The jugular vein was not operated on primarily in any of the 8 cases in this group. In 3 (Cases 3, 4, and 5), subsequent ligation was necessary because of the patients' condition. The temperature charts of these patients demonstrate their extreme illness.

The leucocyte count was relatively high, except in Cases 2, 5, and 8, and in Cases 5 and 8 the condition was really leucopænia. One patient (Case 5) was extremely ill, and was found to have a very virulent infection of the blood stream due to hæmolytic streptococcus.

Blood cultures were positive in Cases 3, 5, 7, and 8, while in Case 4, in which the patient was most critically ill, cultures were repeatedly negative. No two patients were infected with the same organisms, and no regular interval elapsed before the blood culture became negative.

The temperature was fairly typical of sepsis, except in Cases 2, 6, and 8, in which it was almost afebrile.

Choked disc occurred in Cases 5, 6, and 7, probably the result of general toxæmia. Blood transfusion was used as a supportive measure in Cases 3, 4, and 5 with a rather striking result in Case 3. This patient was infected with streptococcus viridans and it is possible that the donor may have been immune to this bacterium. It was apparent that a bacterial shower occurred into the blood stream at the time of a postoperative dressing in Cases 1, 4, 5, and 7.



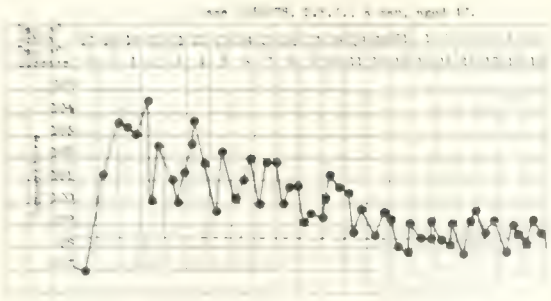


Fig. 9. Case 9. Postoperative course: First day: blood culture positive, long and short chain streptococcus, leucocytes 14,800; chest condition same; fluid not removed; respiration 60. Fourth day: blood culture negative; leucocytes 22,200; respiration gradually reduced and patient more comfortable. Gradual improvement continued until the twenty-second day; the respiration, pulse, and temperature ran a normal course for several days. The patient was dismissed on the twenty-fourth day following operation.

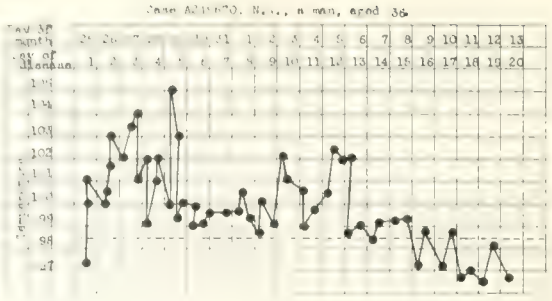


Fig. 10. Case 10. Postoperative course: immediate course stormy; high temperature, rapid pulse. Patient very restless and uncomfortable, difficult to manage. Resented examination and so forth. Blood culture negative 24 hours after operation. Fifth day: facial paralysis, which gradually disappeared. Sixth day: general improvement.

Blood serum immune to streptococcus hæmolyticus was injected intravenously on two occasions in Case 4. Blood culture in this case had been repeatedly negative. No systemic reaction occurred after the injection, but it is possible that there may have been a foreign protein reaction; at least the serum appeared to have a beneficial effect upon the clinical course.

In Cases 4 and 5 the pathological condition was phlebitis without evidence of thrombosis. It is interesting to note that these patients were the most critically ill. Pulmonary complication was present in Case 5, but the patient recovered.

GROUP 2

Case 9. (A235078.) Mr. D. I., age 47, came to the Clinic June 13, 1918, because of discharge from both ears, appearing 2 weeks before. Paracentesis was performed without complete relief. The patient was kept under observation and the condition of the ear seemed to improve satisfactorily from day to day. After 2 weeks he became very ill with chills, pain in the chest, high fever, and severe prostration. He was sent to the hospital, and examination revealed pleurisy with effusion. The leucocyte count was high. A tenable diagnosis of sinus phlebitis was made.

July 19, under local anæsthesia, a complete right mastoidectomy was performed with ligation and resection of the jugular vein and ablation of the sinus. The knee of the sinus lay well forward, and in the region of the tip a pus pocket had uncovered the sinus wall. Further exploration revealed the sinus wall to be covered with plastic lymph and the sinus did not fill as usual; it was uncovered extensively and was incised without bleeding from the bulb end. After some difficulty because of its collapsed condition the vein was ligated below (Fig. 9). Chest complications contra-indicate any such operation under general anæsthesia; but it was believed that the patient's chances for recovery were poor without operation. Local anæsthesia was employed, therefore, with surprisingly little discomfort. The general care instituted was similar to that in cases of pneumonia.

Case 10 (A249670.) Mr. N. W., age 36, came to the Clinic October 26, 1918, complaining of severe pain in the right ear, with chills and fever. The right ear had begun discharging pus several years before, following a "cold." Pain in the right ear and discharge had increased 10 days before. The patient could not rest at night; he had chills and rising temperature. He did not know how long he had been deaf in the left ear. He had been treated recently for typhoid.

The patient was so ill it was necessary for him to lie down during the examination. He held his head rigid and complained of any lateral motion of the head, but the neck was not stiff. The right tympanic membrane was present. A very small amount of discharge appeared to come from near the tube. The wall of the canal did not droop. The right mastoid region was extremely tender, especially over the emissary vein. The glands along the jugular vein were definitely palpable. The cochlea and labyrinth did not function. A diagnosis was made of chronic suppurative otitis media with mastoiditis, labyrinthitis, sinus thrombosis, and intracranial extension.

October 25, operation was performed. The mastoid cortex, thick and eburnated, bled everywhere. Rather dark pus oozed from above and around the knee of the sinus. The dura was covered with granulation. The sinus was uncovered extensively backward, and found to contain an obliterating thrombus. Bleeding occurred in the torcular end after removal of the thrombus. A large cholesteatoma filled the middle ear and eroded the pyramid so

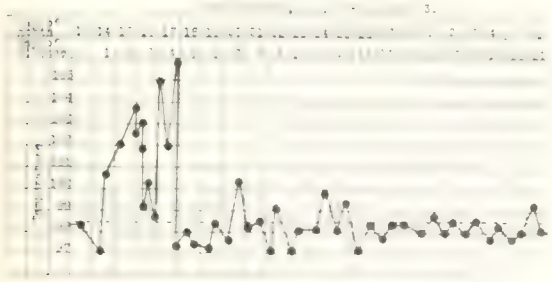


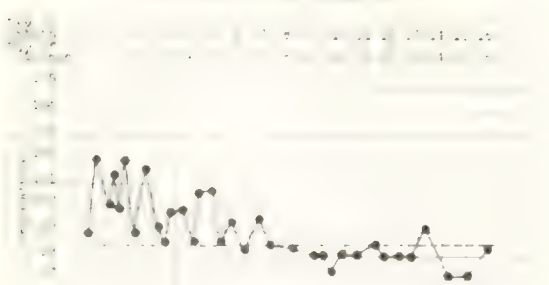
Fig. 11. Case 11. Postoperative course uneventful.

that it was necessary to remove a large part of the petrous portion. Although the dura was exposed extensively, the adhesions were not incised. The facial nerve was found free in the cavity, uncovered by the extensive cholesteatoma. Jugular ligation, radical right mastoidectomy, resection of the petrous portion of the temporal bone, labyrinthectomy, sinus ablation, and extensive decompression were performed. A wick drain was left deep in the [illegible]. Small packs were placed over the sinus and in the rest of the wound. Culture of the blood showed streptococci, pneumococci, and micrococcus catarrhalis (Fig. 10).

This patient had almost all possible complications, involvement being the most extensive in the series. The labyrinthectomy was performed after the method of Neuman and was easily accomplished because the cholesteatoma had destroyed the bone to such an extent that the facial nerve lay free in the cavity. Touching the nerve made the face twitch. Paralysis which developed on the fifth day began to improve after about 3 weeks. It is significant that this patient had been treated for typhoid fever before coming to the Clinic.

Case 11. (A258651.) Mr. L. L., age 33, came to the Clinic January 31, 1919, because of chronic suppurative otitis media, with right mastoiditis. He complained of dull ache in the vertex of the head. He had had scarlet fever and measles in childhood. His right ear had begun to discharge 12 years before, following pain of a few days' duration. The ear had ruptured spontaneously and had discharged almost continuously until 1 year before, when the discharge had been scant. The patient had had tinnitus and had been dizzy at times but he had had no real attack of vertigo. The pain in the right mastoid region had been more severe when the discharge was scant.

Pus was noted in the middle meatus, especially on the left side of the nose. During examination of the right ear, a perforation in the region of the attic allowed the probe to pass into the attic, releasing a



foul discharge. The cochlea and labyrinth did not function. Roentgenogram of the right mastoid region failed to give evidence of mastoid cells. Examination of the left ear showed a retracted drum. The teeth showed marked caries. A diagnosis was made of right chronic suppurative otitis media with chronic mastoiditis and latent labyrinthitis.

February 14, radical mastoidectomy and labyrinthectomy were performed. The mastoid antrum, the cortex of which was sclerotic, was filled with a cholesteatoma and granulations. The horizontal canal was largely destroyed and filled with granulations. The facial nerve, covered with granulations, was so superficial that manipulation repeatedly caused the face to twitch. During probing in the region of the tube in the hypotympanum, the jugular bulb may have been entered as considerable bleeding resulted, which was controlled with packs. The third day following operation the patient developed definite chills and fever. He was kept under observation, and after erysipelas or general conditions had been ruled out, it was deemed advisable to [illegible] sinus.

February 17, a second operation was performed, consisting in jugular ligation and ablation of the sigmoid sinus. Incision caused bleeding from the lower end, but not from the upper. The sinus was slit widely and a large thrombus, 7.5 centimeters [illegible]

There is nothing about the clinical course in this case that would not be considered typical and satisfactory. The thrombus was found in the lateral sinus and not in the bulb.

Case [illegible]. Mrs. A. W. R., age [illegible], came to the Clinic [illegible], complaining of discharge from the left ear, pain [illegible] region. She had had trouble in the left ear intermittently for 4 years. The last attack began 10 days before following a "cold" in the head when the left

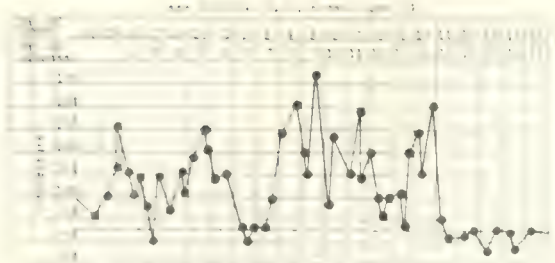


Fig. 13. Case 13. Postoperative course. For 7 days after ligation of jugular vein temperature curve indicated sepsis, but the patient felt much better. The blood culture became negative. There were no signs of meningitis except that the optic discs were blurred on the eleventh day. No explanation could be offered for the course, except that the blood infection was still present. Dismissed to out-patient service on the eleventh day following operation.

ear had begun to discharge foul mucus. The region behind the left ear had become swollen almost immediately and chills had persisted for several days; the temperature had not been taken.

The canal wall of the left ear did not droop; there was a scanty discharge. The mastoid region was tender to touch at the tip, but not over the emissary vein; there was no swelling. The leucocytes numbered 7,900. Culture of the blood was positive for pneumococci.

October 19, operation was performed. The mastoid cells were filled with pus. The sinus was exposed by the disease process and the walls were eroded. An obliterating thrombus was removed and free bleeding from both ends resulted (Fig. 12).

The evidence on which the sinus involvement was diagnosed was the general appearance of the patient, the history of chills, and the positive blood culture. Recovery was unusually rapid.

Case 13. (A306114.) Mr. R. B., age 24, came to the Clinic February 21, 1920, complaining of acute earache on the right side, of 10 hours' duration. Paracentesis gave complete relief.

The patient had severe follicular tonsillitis; there was considerable discharge from the right ear and some tenderness over the mastoid antrum. He was observed in the hospital for 5 days; the tonsils remained large. Roentgenograms did not show evidence of mastoid cells on the right. The leucocyte count was 11,000.

February 27, a complete right mastoidectomy was performed. A small contracted mastoid with sclerosis was revealed. The cells were small, some filled with infected granulations, and many with pus. The knee of the sinus lay well forward and the cells over the tip of the mastoid were fairly large. The sinus was purposely exposed over a large area. In the region of the middle ear the mastoid antrum was found to lie back, the aditus ad antrum was very

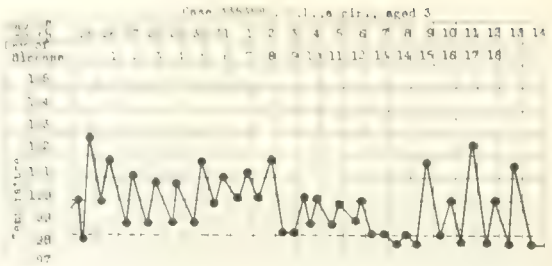


Fig. 14. Case 14. Postoperative course: No particular incident. Child sat up day following operation and played with toys. The temperature curve is best explained on the urine findings. The child was kept on alkalies. No signs or symptoms of illness at any time. As the condition of the urine cleared the temperature decreased.

small; these findings account for the condition. The patient was not subjectively improved after this operation (Fig. 13).

March 6, a second operation consisting of ablation of the sinus and ligation of the jugular vein was performed. The surgical diagnosis was perisinus abscess with sinus thrombosis. When the sinus in the old wound was uncovered, in the region of the bulb, a perisinus abscess was encountered containing about 1 dram of pus. After the sinus was uncovered toward the torcula and incised, an obliterating laminated thrombus was found. Free bleeding occurred from the torcular end, but not from the bulb. The vein was ligated, because it seemed to be collapsed above the region of the facial nerve. The patient was dismissed 1 month later, in excellent condition.

At the time of ligation, there was some question of the identity of the vein, but it seems perfectly evident that it must have been the jugular because there was no other vein near or in the carotid sheath.

Case 14. (A353580.) E. L., a girl, age 3, was brought to the Clinic March 25, 1921, because of pain and swelling behind the right ear. After a severe "head cold" about 1 month before, pain had developed in the ear with spontaneous rupture within 3 days. Two weeks later the region behind the ear had become swollen.

The child did not look well. The canal of the right ear showed a thick purulent discharge and the superior wall drooped. A large red swelling fluctuated over the tip of the mastoid. The leucocytes numbered 20,000 and there were pus cells in the urine. The diagnosis was right mastoiditis with subperiosteal abscess.

March 26, operation was performed. A very large subperiosteal abscess and definite perisinus abscess were disclosed. The mastoid cells were broken down by the disease process, and the sinus was found to be obstructed by an organized thrombus. The bulb and torcular ends bled freely after the removal of the thrombus (Fig. 14).

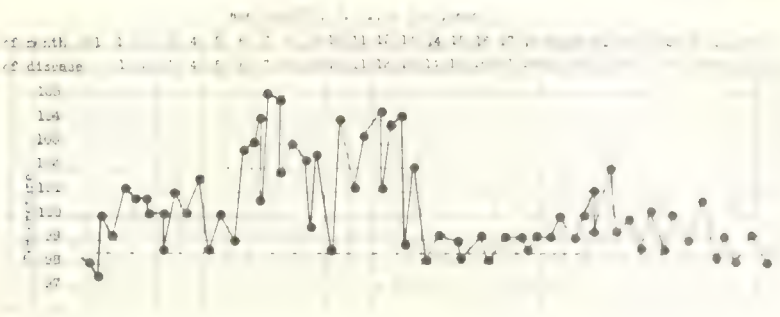


Fig. 15. Case 1. Postoperative course. First to [illegible] temperature rose to [illegible], blood culture hemolytic [illegible] spinal fluid, negative; patient appeared septic; no chills or sweating. Involved sinus suspected, although temperature remained high. Eighth day: transfusion [illegible] method; 200 cubic centimeters. Ninth day: jugular ligation and ablation of the sinus; no bleeding from bulb end. Thirteenth day: symptoms have been fairly typical of sepsis; blood culture negative; leucocyte count 9,800; hæmoglobin 50 per cent; choked discs of both eyes with venous engorgement. From then on no [illegible] incident. Patient dismissed to out patient service on [illegible]. Choked discs gradually cleared up during the convalescence.

This child was without history or signs of sepsis. Blood culture was not taken. There is little doubt but that this sinus condition would have spontaneously cleared up if the mastoid had been taken care of. The condition of the urine in such a case must be considered in searching for the cause for a rise in temperature.

Case 15. (A359708.) I. S., a girl, age 7, was brought to the Clinic May 31, 1921, because of discharge from the right ear with swelling over the mastoid region, headaches, and fever. In the winter of 1920, 2 days after the onset of earache, she had had a right mastoid operation elsewhere, and completely recovered. In the winter of 1921, following a "head cold," the right ear had begun to ache, the drum membrane had opened, and the ear had started and continued to discharge pus. The swelling behind the ear had been becoming larger and more tender gradually. The child had been sick but did not have chills; her head had ached almost constantly.

Examination revealed frank mastoiditis on the right side. The leucocytes numbered 18,000, the hæmoglobin was 50 per cent. The urine contained pus cells. The child was sent to the hospital immediately.

June 1, operation was performed. The usual mastoid incision released several drams of fluid pus from a subperiosteal abscess. The outer cortex was necrotic and contained several fistulæ. A large cavity in the mastoid region was filled with pus and granulation. The wall of the sinus was exposed by the disease process, and was covered with granulation. The sinus was aspirated and found to be patent (Fig. 15).

Inasmuch as the postoperative course was without incident until the sixth day, it is probable that the thrombus formed after operation. Because the temperature was not entirely typical of sepsis there was some doubt as to the sinus involvement. Conditions in young children do not necessarily run a clinical course true to type. The positive blood culture confirmed the suspicion of sinus involvement. Choked disc appeared in both eyes, but examination of the spinal fluid was negative. The leucocyte count proved a fair index of this patient's condition; at the onset it was 18,000, but gradually decreased. The blood culture was negative seven days after the jugular operation.

Summary of Cases in Group 2

In Cases 9 and 10 a primary operation was performed on the vein because bleeding did not occur from the bulb end of the sinus. In three cases (Cases 11, 13, and 15) the operation on the vein was performed secondarily, because symptoms and signs of sepsis came on during the postoperative course and at the second operation bleeding did not occur from the bulb end. In Case 13, the disturbance may have been present but not recognized at the time of the primary operation. In Cases 11 and 15, the condition may have resulted from injury to the sinus wall at the time of

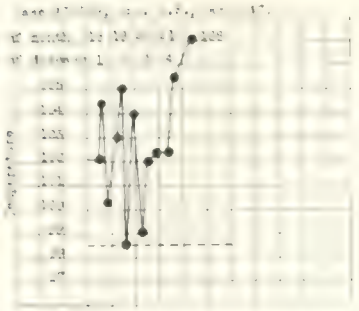


Fig. 16. Case 16. Temperature curve in a fulminating fatal case. No operation. Death on the fifth day.

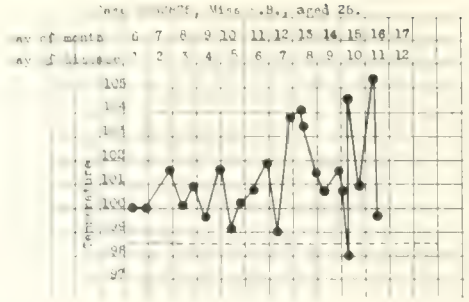


Fig. 17. Case 17. Postoperative course: First day: patient uncomfortable; indefinite chest findings only signs. Temperature curve not unusual. Fourth day: patient's skin discolored by touching. Patient delirious. Blood culture positive; short chain streptococcus. Patient failed fast. Sinus involvement indicated but operation seemed useless. Fulminating infection. Seventh day: definite chill; metastasis to joints. Twelfth day: gradually worse; death. Necropsy: Marked bilateral disseminated bronchopneumonia; fibrous adhesive perisalpingitis, and mural thrombus right lateral sinus.

primary operation; in Case 11, from injury of the bulb with a probe, and in Case 15, from injury by needle puncture to determine the patency of the sinus. In Cases 12 and 14, in which the vein was not disturbed, the patients had an uneventful convalescence. The leucocyte and differential blood counts were not particularly illuminating in any of the cases. The counts were not high, even in the presence of infection in the blood. The patient's general appearance seemed to be the best index of his condition.

In 6 cases the blood cultures were positive; in 1 case (Case 14) no culture was made. The patients were all infected with different organisms. The annoyance given the patient by daily blood counts and blood cultures is scarcely warranted in these cases. The temperature curve was quite characteristic in Cases 9, 10, 11, and 13, but in Case 15 it was definitely misleading. In Cases 12 and 14 the patients were nearly afebrile. Choking of the disc occurred in Case 15, and because of low hæmoglobin in this patient, blood transfusion was given as a supportive measure. The beneficial effect was immediate. Grouping before transfusing is imperative. In Case 9, operation was performed under local anæsthesia because of complication in the lungs. In general, it may be said that the patients in this group were not so extremely ill as those in Group 1. In no case was the vein resected. It is highly probable that the patient in Case 14 would have recovered even if the thrombus had not been disturbed.

It is significant that the patient in Case 11 had been treated elsewhere for typhoid in spite of disease in the ear and mastoid.

GROUP 3

Case 16. (A70389.) Mrs. A. F., age 47, was examined March 18, 1919. She complained of sore throat of about 10 days' duration. Earache on the right had begun 6 days before with spontaneous discharge, chills and fever, and marked prostration.

Examination revealed the membranes of the throat to be full and red, the lips covered with sordes, the tongue dry and fissured, the soft palate and pharynx œdematous and dry, the right mastoid tender, the right ear discharging thin serum, the temperature 102.6°, the pulse 130, and the respiration 32. Signs of sepsis were definite. Blood culture showed streptococcus hæmolyticus. The leucocyte count was 20,800. Examination of the urine indicated toxic nephritis. A diagnosis was made of septic sore throat, and suppurative otitis media, with mastoiditis and sinus thrombosis (Fig. 16).

At first it was believed that the sepsis might be due to the condition of either the throat or ear, and it did not seem good judgment to operate. Death occurred on the fifth day.

Necropsy revealed (1) acute thrombo-ulcerative mitral and tricuspid endocarditis, (2) multiple metastatic arthritis, (3) thrombosis of the right lateral sinus, (4) left posterior ethmoid sinusitis, and (5) hæmolytic streptococci in the blood.

It is highly improbable that surgical interference would have terminated successfully.

Case 17. (A262875.) Miss E. B., age 25, came to the Clinic March 6, 1919, with a discharging right ear. Following an acute "cold," she had had severe pain in the right ear, with spontaneous rupture in 24 hours. She had been unable to sleep because of pain. Profuse drainage had continued, and there

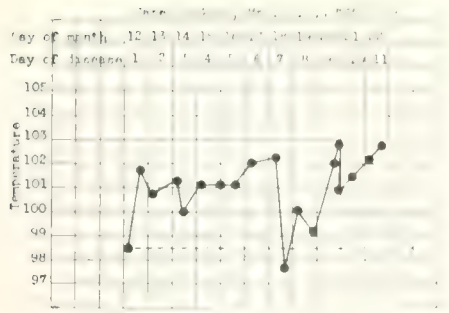


Fig. 18. Case 18. Temperature curve. Patient *in extremis* throughout. Late stage of the disease. No operation.

was tenderness behind the ear. Paracentesis was performed without complete relief.

The patient appeared tired, pale, and sick. She was sent to the hospital. The mastoid was tender, the discharge from the ear copious. The leucocyte count was 14,200. Examination of the urine was negative.

March 10, a complete mastoidectomy was performed. The mastoid was the small-cell type, the mastoiditis hæmorrhagic. Cultures were made. The bone was not broken down. The sinus and dura were not uncovered. A gauze wick was left in the ear, and a vaselin pack in the mastoid (Fig. 17).

The patient's rapid failure was appalling. The influenza epidemic was at its height, and although the condition of the sinus was recognized, it was felt that further operation was not justified. However, if such a case were again encountered, it is probable that surgical interference would be instituted in order to make sure that everything possible had been done.

SUMMARY OF CASES IN GROUP 3

The 2 patients in this group were so extremely ill and the infection so overwhelming that operation was not attempted. The septic sore throat in Case 16 made it difficult to determine the true source of the sepsis, even in the presence of the suppuration of the ear. The patient in Case 17 did not do well from the beginning of treatment, and became mentally disturbed. Soft parts discolored if handled. The site of the needle puncture for the blood culture began to slough in 24 hours. It was believed, therefore, that surgical interference would be a useless and misdirected procedure.

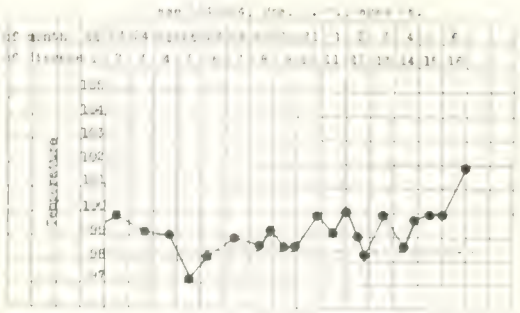


Fig. 19. Case 19. Nearly afebrile course of a fatal case recognized and thought to be a true post-phlebitic abscess. Death occurred on the sixteenth day. Necropsy revealed thrombosis of the straight and lateral sinus.

GROUP 4

CASE 18. V. [illegible] Mrs. G. [illegible] age 25, was examined in the Clinic July 12, 1920, because of dyspnœa, discharge from the ears, delirium, and general bodily ache. She had had influenza 6 months before, from which she had not fully recovered. The present illness had begun about 6 weeks before with measles or scarlet fever. After 10 days she had had a relapse with high fever and pain in both ears. The ears were opened, but she had since become progressively weaker and she had taken practically no food since the relapse.

General examination revealed evidence of pneumonia with effusion, strongly suggestive of tuberculosis. Both ears were suppurating. There was no mastoid tenderness or palpable cervical glands. Neurological examination was practically negative. Blood culture, July 14, showed pneumococci; July 19, culture was negative. The leucocyte count was 15,800; hæmoglobin 50 per cent. Examination of the urine was negative.

The patient was delirious and thoroughly septic throughout the course of the illness. She died after 11 days. At necropsy were found: (1) thrombosis of the right lateral sinus, (2) multiple abscesses of the lung, and (3) left empyema. Guinea pig inoculation revealed miliary tuberculosis of the liver, spleen, peritoneum, and pancreas (Fig. 18).

If a differential diagnosis had been made in this case operation would not have been warranted, because the patient was so extremely ill. In such a case it is possible for the end-stage to obscure the picture so greatly that thrombosis might be considered, but the management would not be greatly different. The ear was examined 2 days before death, when the patient was *in extremis*. No attempt was made to assign the cause of the trouble to an extension from the ear. If the patient had been seen 3 weeks earlier, the prognosis would have been better.

headache and pain in the shoulder. She had had trouble with both ears since childhood. Four weeks before examination she had had a "head cold," followed by earache, more marked on the right. [illegible] to bed. One day she had felt chilly. She had been markedly drowsy for several days, then improved [illegible] few days.

The eye grounds were negative; the blood showed [illegible]ndary anæmia; the leucocyte count was 7,800; the examination of the urine and roentgenograms [illegible] the chest were negative. The patient had many infected teeth. The canals of both ears were nearly occluded by fibromyxomatous polyps, which were partially removed to facilitate drainage. Tenderness was not demonstrated over the mastoid. The patient was advised to enter the hospital for observation, because of the possibility of intracranial extension, but she refused. Five days later, she felt worse and a physician was called to her boarding house. She was in a rather stuporous, apathetic state, and complaining of headache. She was taken to the hospital.

Examination of the spinal fluid was negative, the leucocytes numbered 9,800. The pulse was 60. Eye grounds showed slight haziness of the discs. The neurological examination suggested the possibility of abscess, but there were few positive signs.

Exploration was performed December 18, but abscess was not found. The evidence of pressure indicated encephalitis (Fig. 19).

The patient did not react well to the anæsthetic, continuing very drowsy and stuporous; her pulse was slow and full. The third day she was much clearer mentally, but her head ached severely, and her neck was rigid. Babinski's sign was positive; Kernig's was negative. The fifth day she was drowsy, but was aroused easily and appeared clear mentally. Her condition was not good. Little change had occurred on the seventh day. The tenth day, the culture of the spinal fluid, 32 cells, was positive; temperature and pulse rose slowly. The eleventh day, she suddenly became worse; tonic convulsion occurred, followed by difficult respiration, cyanosis, and death.

Necropsy revealed (1) organized thrombus of the right lateral and straight sinus, (2) hæmorrhage into the right temporosphenoidal lobe on the side explored, and (3) encephalitis.

The patient's home physician, after her death, told of having seen the patient early in the disease, at which time she had had definite chills and high fever. If this information had been available the involvement of the sinus would have been suspected. The patient had not been able to give her symptoms and her husband had appeared indifferent. The drowsiness, headache, and general malaise were probably owing to the intracranial circulatory changes resulting from the thrombosis of the straight sinus. This case and Case 18 illustrate the difficulty of recognizing a sinus involvement some weeks after the onset.

SUMMARY OF CASES IN GROUP 4

Case 18 represents a patient in the end stages, the result of septicopyæmia, when operation had been delayed too long. Her ear was examined 2 days before her death. The history was typical. It is interesting that the guinea pig into which the infection was injected died subsequently from miliary tuberculosis. The blood culture was positive for streptococcus hæmolyticus. Case 19 presented the most unusual clinical problem encountered. Thrombosis of the straight sinus probably accounted for the symptoms suggesting brain abscess. Death was due either to intracerebral hæmorrhage at the site of the exploration (but this may occur with any exploration and prove fatal), or to circulatory disturbance due to thrombosis. Headache, drowsiness, and mental apathy may be caused by circulatory changes secondary to thrombosis of the straight sinus. In the presence of such symptoms, brain abscess and thrombosis of the straight sinus must be considered in the differential diagnosis.

GENERAL CARE

In general, patients with involvement of the sigmoid sinus must have careful, cheerful nursing in well-lighted, well-ventilated rooms. In several instances remarkable improvement took place in patients who had been transferred from dull, cheerless surroundings to well-lighted, well-ventilated rooms. Such patients are immediately placed in the best possible quarters as a routine measure.

The nursing is an extremely important factor. It is customary to impress on the nurse that the recovery will depend largely on her efforts and hearty co-operation. Forced diet and large liquid intake should be encouraged as supportive measures even when the temperature is high. Unnecessary examinations, such as blood counts, blood cultures, and needless dressings, annoy the patient who

is using all available reserve to combat the infection. They may seriously handicap and prolong the convalescence and should be avoided.

CONCLUSIONS

1. Patients should be treated individually rather than by one routine surgical procedure.

2. Primary operation on the jugular vein is not definitely indicated unless bleeding does not occur from the lower end of the sinus.

3. The operation on the vein may be safely delayed, if both ends of the sinus bleed freely and the patient seems to be in fairly good condition. In none of the cases was the vein resected.

4. Too much dependence must not be placed on laboratory findings. The general appearance of the patient is a fairly reliable index of the condition.

5. Blood transfusion by the citrate method, care being taken properly to group the patient, is a valuable supportive measure.

6. Unnecessary handling and examination should not be done as it annoys the patients.

7. Forced feeding, quiet pleasant surroundings, and cheerful nursing are important factors.

8. Patients with lung complications may recover.

9. Thrombosis of the straight sinus may cause symptoms and signs of brain abscess.

10. The prognosis may be said to be fairly good if well-directed measures and timely surgical interference are employed.

RECURRENCES FOLLOWING OPERATIONS FOR INGUINAL HERNIA

By WILLIAM HESSERT, M.D., F.A.C.S., Chicago

ALL surgeons admit a certain percentage of recurrences after operation for the cure of inguinal hernia, even when the wound has healed by primary intention. That infection is generally followed by a recurrence of the rupture requires no further comment, and it is not with this class of cases that the discussion which is to follow is concerned. This paper is confined to a study of the causes leading to recurrence in clean cases.

The average operator is prone to underrate the percentage of his recurrences. Patients with a recurrence are generally nursing a grievance and are not likely to return to the first operator. Only in clinics with enormous material can cases be followed up in sufficient number to supply data which will be of any value. In Bloodgood's opinion, statistics can be deemed absolutely reliable only when based on an actual re-examination of the patient by the original operator himself. It requires experience to detect an early recurrence, which might easily be passed unobserved by the general practitioner or by the patient himself. If the statistics of the various authors were compiled according to a definite standard, they would be of much more value than the divergent figures at present available.

Bloodgood, in 1919, studied the results of operation in Halsted's clinic in the early days when suppuration was frequent and found recurrences in 25 to 30 per cent of the cases. When the wound healed *per primam*, the recurrences were alleged to be 6 per cent. This estimate was probably much too low. Taking it all in all, most surgeons of modern times admit from 5 to 10 per cent recurrences, all cases considered.

Fantino's ratio in 4200 cases was 1.7 per cent. Twenty-seven of the 74 which recurred were direct herniæ. Downes records 10 per cent for direct herniæ. Coley's figures are low, probably because so many children are included in the series. They are 2.6 per cent for the Bassini, and 4 per cent for the Ferguson operation. Taylor's compilation of 816 cases of indirect hernia operated upon at Johns Hopkins Hospital represents what is probably a fair average, 5.6 per cent. Of Davis' collection of 1500 patients operated upon at the Massachusetts General Hospital, 15 per cent recurred. Judd, speaking of both

varieties of hernia, states that 70 per cent of all recurrences come within the first 6 months, and 90 per cent within the first year. That a supposedly simple operation like a herniotomy, should, at the hands of the most expert technicians in the foremost hospitals, be followed by such a high rate of failure is significant. What is wrong? I should say that, fundamentally, it is the failure of the operator to individualize in each and every case. It is his failure, not through ignorance, but rather inattention, to observe carefully the structures laid bare in his dissection, to note the variations in the anatomical development, and to employ that plastic which is the proper one for the case at hand.

Moschcowitz tersely tabulated the causes of recurrence as follows, viz.:

1. Proper operation improperly done;
2. Improper operation properly done;
3. Improper operation improperly done.

The different factors, anatomical and technical, which are involved in a recurrence, can, for the purpose of study, be enumerated as follows:

1. The type of hernia—

Direct and indirect;

2. Variations in the normal anatomy of the inguinal region—

The conjoined tendon and aponeuroses;

3. The type of operation—

Involving mainly the question of transplantation of the cord and imbrication.

4. Sliding herniæ.

1. THE TYPE OF HERNIA

The ratio of direct to indirect herniæ is about 1 to 20. Recurrences in direct hernia are not only more frequent, but occur earlier than in the oblique. Coley states that 80 to 90 per cent of the recurrences in direct hernia occurred in the first year—the majority in the first 6 months. If a patient remains free from recurrence of direct hernia for the first 6 months, the probability is he will remain cured. In direct hernia, Coley had 15 per cent recurrence. Taylor reports 47 known results in direct hernia with 18 per cent failure.

Bloodgood, in 1918, wrote as follows about direct hernia: "There is, however, a small group of herniæ which can be easily recognized at the first examination, for which up to the present time (1918) operation failed to result in a cure in from 20 to 50 per cent of cases. I called attention to this small group of herniæ in 1899. Among 243 cases of inguinal hernia, this type occurred in eleven instances, about 4.5 per cent. Among these 11 cases there were 6 recurrences in from 6 weeks to 6 months after operation. In the larger group there were 1 per cent recurrences."

What is there about a direct hernia that makes it more difficult to cure than the indirect?

In the first place, the anatomical defects in the shape of deficient conjoined tendon are not considered by the operator in choosing the proper operation. Again, the sac did not receive proper care as to removal or inversion. A Bassini or Ferguson, without transplantation of the cord, would surely result in failure. Transplantation of the cord, according to Halsted, with an Andrews imbrication, is the best technique for these cases. If additional firmness is desired, a flap of fascia from the rectus sheath will answer the purpose better than to transplant the rectus muscle.

2. VARIATIONS IN THE NORMAL ANATOMY OF THE INGUINAL REGION

The conjoined tendon. In a paper which I read before this Society in January, 1913, entitled "Some Observations on the Anatomy of the Inguinal Region, with Special Reference to Absence of the Conjoined Tendon," I described my clinical findings. I called attention to the frequency with which the conjoined tendon was found attenuated or entirely absent, and described the condition fully. It was my opinion then, as it is now, that this anatomical defect had much to do with the original development of direct hernia, as well as with recurrence, especially if the improper operation had been performed. Prior to my publication, Bloodgood had been the only one to pay any particular attention to the conjoined tendon. I was at that time ignorant of his work and my observations had been made independently. My paper passed quite unnoticed, but it will appear evident from quotations from Bloodgood

which will follow presently, that he appreciates more than ever the importance of this matter. The profession, as a whole, judging by the literature, is still indifferent.

In my paper I asserted that the deficiency of the conjoined tendon could be detected clinically by the examining finger before operation, and since that time I have repeatedly demonstrated at operation that the palpating finger is correct in diagnosing absence of the conjoined tendon.

Associated with absence of the conjoined tendon it has been my experience to find developmental defects of the external oblique fascia. This fascia over the inguinal canal will be found to be thin and atrophic, with its fibers separated and even displaying the muscle underneath. In these cases the external ring is abnormally large, admitting the tips of one or two fingers easily. This condition of atrophic fascia and large external ring is not the result of a hernial protrusion, for it is demonstrable in cases where no hernia exists. Such a condition can be called a "predisposition," and when it accompanies a real hernia on the other side, it should be operated upon.

Bloodgood says: "In these cases in which this examination detects the complete absence of the conjoined tendon, the ordinary operation for inguinal hernia, according to my investigations up to 1899 failed to cure in about 50 per cent of the cases. The majority of operators today admit about 5 per cent recurrences in all cases of hernia. I am of the opinion that the majority of these recurrences are not due so much to the fault of the ordinary operation, as to the type of hernia and the absence of the conjoined tendon." Bloodgood has read most of the contributions of the surgeons who operated in our various training camps during the war and has failed to find a single mention of the conjoined tendon.

Bloodgood employs the term "obliteration" in discussing the various degrees of maldevelopment of the tendon. This term would imply the previous existence of the structure, and that it had been caused to shrink or disappear entirely by some outside agency, like the pressure of a hernial sac.

That Bloodgood himself felt some uncertainty regarding this term is shown by what he wrote in 1898: "The term 'obliterated' is used because the extreme condition is more likely to be an acquired one rather than congenital." I believe in the congenital theory because the extreme condition or complete absence of the tendon is often found where there is no hernia present at all, and even if a hernia is present, it is not the cause of the atrophic condition of the tendon, but a result of the same.

However, the important point to be recognized at the operation is that the conjoined tendon is either absent, very narrow, or very attenuated, and that the lower angle of the inguinal canal (Hesselbach's triangle) has lost its strongest support and that something must be substituted for this defect at the operation for hernia. Bloodgood recommended transplanting the rectus muscle down to Poupart's ligament, but Halsted never advocated the employment of this feature, maintaining that the rectus muscle in functioning would tend to draw back into its natural position. This was borne out by the experience at Johns Hopkins, for in 34 cases in which it was tried there were 35.3 per cent recurrences.

Taylor found that among his cases where the conjoined tendon was absent recurrences took place in 37.5 per cent.

I want to emphasize that in cases where the conjoined tendon is absent, a Bassini operation cannot be performed, for it is physically impossible to bring the innermost fibers of the internal oblique and transversalis muscles down to the spine of the pubes. I believe it is owing to the persistence of operators in employing the Bassini method in direct or indirect herniæ with absent conjoined tendon, that many recurrences are traceable. The technique which fulfills the indications is the imbrication method, after Andrews for the oblique variety, and with the Halsted cord transplantation for the direct hernia.

3. THE TYPE OF OPERATION

In the various operations in which the cord is not transplanted, whether the aponeurosis is overlapped or not, the possibility of a

recurrence always exists at the point of emergence of the cord at the median angle of the plastic. It is self-evident that any operation in which the cord is not transplanted, as in the Ferguson, is bad in direct hernia with absence of the conjoined tendon. In this connection Coley's statistics are suggestive, for, while he had 0.6 per cent recurrence following the Bassini method, there were 4 per cent following the Ferguson, in which the cord is not transplanted.

Coley believes that it is a great disadvantage to bring the cord out superficial to the aponeurosis and covered only by skin. The disadvantages of the Halsted operation have been the recurrences at the site where the cord came through the aponeurosis. Coley believes that the cord should be covered by fascia as in the Andrews' method. It is true that in indirect herniæ the Halsted operation is not the best choice, for it leaves a weakness in the aponeurosis at the internal ring, which is just the point where this hernia is most likely to recur. In direct herniæ, however, the Halsted operation with imbrication is best, for the cord is kept away from the point of greatest weakness, the inner angle.

4. SLIDING HERNIA

Judd had 14 cases of sliding hernia with 3 recurrences. I believe that, were the facts known, it would be found that most sliding herniæ recur. This is to be expected when you consider what a sliding hernia is, and that at operation one of the fundamental conditions for cure cannot be complied with, namely, excision of the sac. With this handicap, these cases present a difficult problem indeed. Various plastics on the bowel have been devised to do away with the sac, but without much ultimate success. These patients are usually fat, with atrophic muscles and friable tissues, making any kind of repair difficult. If the cord could be eliminated, it would add greatly to the stability of the repair. Castration is justifiable, the patient consenting. If one is accustomed to operate under local anæsthesia, that question can be settled on the spot. The cord removed, it is then a matter of layer sutures, taking care that no weak areas are left.

Recurrences have their beginning as a general rule at two points: (1) at the internal ring, and (2) at the external ring.

1. AT THE INTERNAL RING

Among the causes for recurrence at the internal ring are (a) faulty ligation of sac, (b) faulty suturing about the internal ring, (c) Halsted transplantation of the cord, without excision of varicose veins or lipomata.

a. Faulty ligation of sac. The most essential feature of every hernia operation is the high ligation of the sac. This has been well brought out by the fairly good results obtained by the simple operation of Kocher. One of the points emphasized by Halsted in his early work was the high ligation of the sac. There seems to remain little of the original operation of Halsted and Bassini that is really essential, except the clear and free exposure of the entire inguinal canal, which makes possible the high ligation of the sac. In children, high ligation alone will cure the rupture irrespective of the plastic. While no one will gainsay that recurrence is invited by a low ligation, which leaves behind it a funnel of peritoneum, yet many operators are at times careless in this matter. A preformed sac, even though it be small, will be the starting of a hernia. To eliminate any possibility of dimpling at the point of ligation, some operators draw the stump away from the internal ring and anchor it to the muscles.

How important a preformed sac is in the production of indirect hernia was first brought out in a paper which I read before this society in 1910 on "The Frequency of Congenital Sacs in Oblique Inguinal Hernia." I expressed the opinion at that time that most indirect hernial sacs had their beginning in a patent tunica vaginalis. That this opinion on the etiology of indirect inguinal herniæ is being shared by others, is shown in an article by Masson, in the *Collected Papers of the Mayo Clinic* for 1918. Masson states: Probably 75 per cent of all indirect herniæ are the result of a persistent congenital sac."

What disposition should be made of the sac in direct herniæ? We all agree with Bloodgood that in small direct herniæ not much is gained by opening the sac, and that when

one pulls it out for high ligation there is some risk of injury to the bladder. There is no evidence that failure to open, partially excise, and close a sac of this kind has anything to do with recurrence. A simple way to dispose of a small unopened sac is to insert a circular purse-string suture and invert.

When the sac is of larger size, it had best be opened and excised, keeping in mind always the bladder, which may be on the inner side of the sac. In the case of a double or pantaloon sac, it has been suggested that one pull the direct sac to the outer side of the deep epigastric vessels and tie off the two sacs as one. While this maneuver has no advantage over separate ligation, it may be followed by injury to the vessels and trouble some bleeding.

b. Faulty suturing about the internal ring. The so-called internal ring is not so much a ring anatomically as it is a weak spot. The cause of the weakness is the migration of the testis. In all hernia operations this region should receive especial care in suturing. I believe Coley was the first to advise one or two sutures of the tissues above the cord. Thus, in the Andrews imbrication, the structures are sutured from the spine of the pubes to the internal ring. Thereupon a suture is placed above the cord leaving an opening just large enough to avoid constriction. This suture includes the edge of the external oblique fascia and internal oblique muscle, which are sutured to Poupart's ligament. I consider this suture second in importance only to the one at the pubic spine.

c. Halsted transplantation of the cord without excision of varicose veins or lipomata. The view is held by many that the straight course of egress of the cord at the internal ring creates a weak point. This is true to a certain extent, especially if the sac has been tied too low and no reinforcing suture has been put above the cord. For this reason this plan of disposing of the cord is advisable in direct herniæ only. In the indirect herniæ, the Andrews imbrication is much to be preferred.

Now as to the veins. If the veins could be excised in every case of inguinal hernia and the remainder of the cord transplanted without any danger of orchitis and atrophy of the testicle, a perfect cure could undoubtedly be accomplished in every case. In case the veins are at all in excess of the normal, they should be excised. Due caution and proper judgment should be exercised lest too many vessels are removed and atrophy of the testicle result.

The fatty tissue which accompanies the cord and is often excessive in amount should always be dissected out and removed, that the size of the cord may be lessened. Failure to observe this simple measure may cause trouble.

2. At the External Ring

Recurrences may point at the external ring and for reasons as follows:

a. Direct hernia in which the wrong operation was done, such as a Bassini or Ferguson in case of absence of the conjoined tendon. After any operation in which the cord is not transplanted, recurrences may take place at the inner angle.

b. Indirect herniæ during the process of recurrence may traverse the inguinal canal and appear at the external ring. This would apply to the Bassini or Andrews rather than to the Halsted operation.

Technique

The various operations for inguinal hernia as they are being performed today are all more or less based upon the primary Bassini or Halsted technique. In this country the MacEwan and Kocher operations are no longer in vogue.

Whether the cord is transplanted, as in the original Bassini, original Halsted, posterior Andrews, Torek, Hackenbruch, or Fournel operations, or whether the cord is left in place without overlapping of the external oblique fascia as in the Bull-Coley, Ferguson, or Woelfler, or with imbrication of the aponeurosis as in the anterior Andrews, Girard, or improved Halsted (the so-called Hopkins operation), the essential underlying principle is the removal of the sac and the closure of the hernial opening by suturing the internal oblique muscle and conjoined tendon to Poupart's ligament.

No one operation will fit all cases, but by observing the general fundamental principles, it will be found that the technique need not vary greatly to be generally useful. I have found the Andrews imbrication operation to be the one which best fulfils all possible indications. The only variation in the technique relates to the disposition of the cord. I never leave the cord in its original bed to emerge at the inner angle. The cord should always be transplanted. In direct herniæ the cord is allowed to emerge directly through the aponeurosis as in the Halsted operation. In indirect herniæ the cord lies between the two layers of imbricated external oblique fascia.

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ACUTE INTESTINAL OBSTRUCTION IN INFANCY AND CHILDHOOD

A Brief Review of 55 Cases

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ACUTE intestinal obstruction is fraught with such real danger to the patient and attended with such grave responsibility to the physician, as to make it the most serious surgical affection of the abdomen, in early life. In pediatric practice, other surgical diseases, for the most part, tend toward spontaneous recovery if proper palliative measures are instituted. Conservatism does not carry with it the same risk, and delay is not so apt to spell disaster.

During the last decade experimental research has thrown much light on the physiological, chemical, and pathological problems of acute intestinal obstruction. Leaving out of consideration any purely theoretical or conflicting views, Stone[2] sets forth the following points as being generally accepted:

1. There is found in the lumen of obstructed bowel a toxin which, when injected intravenously into normal animals, causes the symptoms of intestinal obstruction.

2. Certain chemicals are developed, as the result of protein disintegration, and cause the symptoms present in acute intestinal obstruction, viz., fall in blood pressure, temperature disturbances, vomiting, diarrhœa, derangement of kidney function, high nonprotein blood nitrogen, delay in coagulation time of blood, profound congestion of duodenal and jejunal mucosa, collapse and death. Death is due to a form of chemical intoxication.

This paper is based on a study of 55 cases of intestinal obstruction occurring in 53 young subjects. One infant, in a period of 4 months was operated upon twice for acute intussusception and once for postoperative adhesion obstruction. Cases of imperforate anus, congenital intestinal atresia or stenosis, and strangulated external hernia have not been included in this series. A few general facts will be noted: The obstruction developed in infants in 43 instances (78 per cent) and in children (ranging in age from 20 months to 11 years) 12 times. Males were affected twice as often as females, there being 36 of the former and 19 of the latter. With regard to the cause of the obstruction, the cases may be divided into the following groups:

1. Early postoperative band or adhesion obstruction (within 3 weeks of operation), 2 cases. Both cases developed in children shortly after operations for appendicitis.

2. Late postoperative band or adhesion obstruction (developing after 4 weeks), one

[2] Stone, Harvey B. The toxic agents developed in the course of acute intestinal obstruction, and their action. Surg. Gynec. & Obst., 1921, xxxii, 115

[1] Read before the Surgical Section of the New York Academy of Medicine, March 3, 1922

case occurring in an infant, who had recovered from an operation for double intussusception 5 weeks before.

3. Band or adhesion obstruction (without previous operation), 2 cases. The first case was in an infant and the obstruction was caused by a congenital band, from the cæcum to the jejunum, producing angulation and acute obstruction. The second case was in a girl, 8 years old, with appendicitis as the cause of the obstruction.

4. Tumor obstruction, one case, in a 5 weeks old female infant, with a benign tumor (probably an adenocystoma) at the ileocæcal valve.

5. Mesenteric thrombosis, one case, in an infant, with eighteen inches of gangrenous obstructed jejunum.

6. Pressure obstruction, one case, in a child with an intra-abdominal abscess, left side.

7. Foreign body obturation obstruction, one case, in a girl of 11 years who had eaten heartily of plums and had swallowed the stones.

8. Intussusception, 46 cases.

It will be seen that, aside from intussusception, acquired types of intestinal obstruction are relatively rare. In this series intussusception was the variety of obstruction encountered in 83.63+ per cent of our cases. While it may occur at any age, it is essentially and pre-eminently an affection of infancy and early life. A detailed description of the disease will not be given as this has been done in previous papers on the subject. Certain previously uttered statements will be repeated here, in order to emphasize the following points:

1. The cardinal symptoms—pain, shock, vomiting, mucohæmorrhagic stools and the presence of an abdominal tumor—occur so regularly and in such a clear cut and characteristic way as to make intussusception the easiest of abdominal diseases to diagnosticate. It is evident that the rapidity and severity of these symptoms and the course of the disease are in definite relationship to the degree of circulatory obstruction and to the poisoning which results therefrom. The morbid anatomical sequence in the acute variety is as follows: invagination, circulatory stasis with exudation and œdema, infection, inflammation and gangrene of the intussusceptum [illegible]

2. Differential diagnosis seldom presents any difficulties. Ileocolitis (acute dysentery), uncomplicated abdominal purpura, and spastic colitis are diseases which must be borne in mind and ruled out. If there is any doubt in a given case it can, as a rule, be settled by a fluoroscopic or X-ray examination.

3. Experience has shown that 10 per cent is a liberal estimate to be placed on the cases that can be disinvaginated by gas insufflation or hydrostatic pressure. The uncertainty, the danger, and the relative futility of aero hydrostatic measures are not sufficiently understood or appreciated. Early operation is the safest, the simplest, and the only certain plan of treatment, and gives almost uniformly good results in all types of cases, regardless of the age of the patient.

Of the 46 cases of intussusception here considered, 39 were under my care and 7 were under the care of my associate, Dr. W. M. Silleck.

Age. Thirty-nine cases were in infants ranging in age from 6 days to 13 months, and the 7 older patients were from 20 months to 8 years of age.

Sex. There were 31 males and 14 females.

Clinical picture. The physical condition of 36 of the infants was exceptionally good; 2 were in but fair shape; and only 1 of the series was decidedly subnormal. The majority were breast-fed, well nourished, and previously healthy babies. Only 2 of the infants were on artificial feedings exclusively. The condition of the 7 older patients was fully up to the average.

The onset of the attack was more or less typical in all of the cases. Pain was uniformly present. Some degree of shock was noted in most instances. A few cases showed actual collapse during the initial seizure of pain, but there was always more or less reaction later. Vomiting or regurgitation of stomach contents occurred in every case. Vomiting is rarely a prominent symptom until late in the disease. When it appears early and is persistent we have come to look upon it as highly

significant of circulatory strangulation, with the prospect of a rapidly developing gangrene of the intussusceptum. Mucohæmorrhagic stools were present in 44 cases (about 95 per cent.) absent in but two. A distinct tumor or tumefaction was felt in every case, with but two exceptions.

Varieties. Following the simple classification, suggested by Clubbe, our cases can be divided into the following groups: enteric, 3 cases; ileocæcal, 31 cases; enterocolic or double intussusception (entero-ileocæcal and ileocolic-colic), 8 cases; colic, 2 cases. In two instances where no operation was performed the type of invagination was not determined.

Etiology. In two cases, in boys aged 4½ and 7 years, respectively, a Meckel's diverticulum was the causative factor in the production of the intussusception. In another case, in a 6½ months old male infant, a congenital tumor of the cæcum (cystadenoma) was the cause. In another infant, the last 2 inches of ileum, *not involved in an ileocæcal intussusception*, appeared macroscopically to be the seat of a papillary angiomatous growth. The pathologist, however, pronounced the growth to be merely inflammatory. Appendicitis is believed to have been the causative factor in several instances. It has always been our rule to make the removal of the appendix a step of the operation, believing that occasionally appendicular irritation induced the spasm and brought about the invagination. Since the histological study of these appendices has been taken up as a routine measure, it has been found that a certain number of them show definite, acute inflammation, even where no trauma to this organ was present. It is hoped that others will make investigations along this line, for we are convinced that appendicitis is one of the causes of intussusception. Enlarged mesenteric glands were found in a considerable proportion of our cases, but were thought to be the result rather than the cause of the trouble. In the majority of our cases we were unable to find an unmistakable causative factor to account for the intussusceptions.

Recurrence. There were but two cases in our series in which recurrence took place. In the first case, there was a return of symptoms in an infant, upon whom Dr. Silleck had operated 2 days before for ileocæcal intussusception, and, on reopening the abdomen, he reports the finding of a recurrence at the same site, with gangrene of the neck of the intussusceptum, necessitating a resection. The second case was operated on by me for an entero-ileocæcal intussusception. Reduction was difficult and convalescence stormy. Five weeks later I operated a second time for acute obstruction of the lower ileum caused by adhesions. Two months later symptoms of intussusception developed, and, at the operation, performed this time by Dr. Silleck, an ileocæcal invagination was successfully reduced.

Results. One infant who had been ill for 7 days with intussusception was moribund when brought to the hospital and died within an hour of admission. Another late case, ill for 3 days, died on the operating table just as the operation was started. A gangrenous, irreducible, double intussusception was removed postmortem. There was but one successful reduction, without resort to laparotomy. The patient, a girl of 5 years of age, was seen in consultation with Dr. A. H. Cilley and presented the usual history and symptoms of intussusception. Following hydrostatic pressure and postural treatment, relief was obtained. Of the remaining 43 cases, 28 were reducible and 15 were either gangrenous or irreducible or both. In the first group there were 3 deaths, due to an overwhelming toxæmia, 9 hours, 7 hours, and 5 hours after reduction, in infants who had been ill 4 days, 3 days, and 3 days, respectively. Another fatality occurred in a boy who developed a colic intussusception while ill with influenza, during the 1918 epidemic. Reduction was accomplished with ease, about 6 hours after the onset, but death followed 4 days later, and was due to a double influenza pneumonia. Another case developed pneumonia after leaving the hospital and died of this disease on the fourteenth day following operation. Another late death occurred in a 4 months old infant, 21 days following operation, after dismissal from the hospital. In this instance the cause of death was not determined. To sum up the

results in the resection cases. There were 12 cures and 6 deaths, mortality 21.42+ per cent. If allowed to exclude the deaths not directly due to the intestinal obstruction or to the surgical treatment thereof, the mortality would drop to 10.71+ per cent. There were several recoveries in late and profoundly toxic cases. The longest interval between the onset of the disease and a successful reduction was 4 days; the shortest was 5 hours. Every case in this group seen within 48 hours of the onset recovered, with the single exception of the boy who died of influenza pneumonia.

In the second group of 15 cases requiring resection there were 4 recoveries and 11 deaths; mortality 72.4 per cent. Of the thousands of cases of intussusception which have been reported throughout the world, there are on record less than a score of successful resections in infants. In older children the statistics are not quite so appalling. I had the honor, in 1905, of presenting before the Surgical Section of the Academy of Medicine the first successful resection of a gangrenous intussusception in an infant on record. Since that time I have had two other successful resections, one in an infant 8 months old and the third in a boy 4½ years old. The fourth successful operation in this series was performed by Dr. Sillcocks. Of the 11 fatal cases, 9 were in infants.

When this series of intussusception cases is studied as a whole one is impressed with the large proportion of late cases. More than two-thirds were received into the hospital after the first 24 hours, and about one third of the total number required resection. In spite of the fact that diagnosis is easy, no class of cases is more often unrecognized and mismanaged.

There were 27 deaths in this series of 55 cases of acute intestinal obstruction in children, giving a mortality of 40 per cent. This includes the fatalities from all causes, early and late, regardless of whether the patient received treatment or not. The most important factor in this intestinal obstruction problem is to operate early, before involved tissues have undergone serious damage, and before toxæmia has become pronounced. It is the only way to lessen the great morbidity and to reduce the high mortality, which inevitably accompany delay. Finney says it is better to [illegible] than a poor operation on a patient in good condition than a good operation on a patient in poor condition. Van Beuren makes the axiomatic statement that the longer a patient lives with acute intestinal obstruction before operation, the sooner will he die after operation. So much for this phase of the question. Experience has taught us that occasionally an apparently hopeless risk can be converted into a fair sort of a gamble by treatment which combats shock, tissue desiccation, and toxæmia. External heat, appropriate stimulation, stomach lavage, the introduction of fluids into the system by infusion or hypodermoclysis or proctocylsis, are just as much indicated, in selected instances, before operation as after. Following the operative relief of the obstruction, in addition to the measures just mentioned, morphine, atropin and pituitrin, if used judiciously, are agents of proven worth. If threatened gangrene or perforation of the bowel does not force the operator to take radical steps—then a two-stage operation will often prove successful where a single procedure might have resulted in failure. The importance of emptying the loaded segment of bowel above the obstruction is obvious. Cæcostomy in acute obstruction of the large intestine, and enterostomy (particularly jejunostomy) in obstruction of the small bowel—to prevent or to accompany [illegible] operation for the relief of the obstruction—are often life-saving measures. A local anæsthetic should be the anæsthetic of choice, in many of these operations.

PERIOSTEAL SARCOMA IN ASSOCIATION WITH OSTEOMYELITIS

Report of Three Cases[1]

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WHEN, after receipt and study of material from the first case of periosteal sarcoma associated with osteomyelitis, Dr. Bloodgood wrote that he had "never observed sarcoma in osteomyelitis" it occurred to me that it would be of sufficient interest to report. A second case a few months later emphasized this, and finally a third case since the title of the paper was sent to our secretary. I wish simply to record the clinical observation of the cases.

Case 1. University Hospital No. 19647, admitted July 21, 1920. Miss C., age 14, white, suffered with periosteal, large round-cell, alveolar sarcoma of the left tibia with osteomyelitis. The onset was six weeks before admission, with pain in the left knee and leg. Swelling developed just below the knee in a few days, and was lanced but nothing was obtained although the X-ray had shown an osteomyelitis of the upper end of the tibia. Examination on admission to the hospital showed a slight swelling about the knee and the leg a trifle warmer than the right. There was a wound, covered by a dry scab 1 centimeter long on the anterior surface just below the knee. The surrounding skin was red for about 1 centimeter, and the region sensitive upon pressure, lessening as one went farther away, but extending up to the head of the tibia and down about midway the leg. No fluid was found in the knee. Motions of the leg were a little painful. There was no history of trauma, of typhoid fever or any other serious illness. Her temperature did not exceed 99.3°, pulse rate 125 to 150. The urine showed albumin, a few waxy and hyaline casts, and a few red blood cells. Leucocyte count, 16,500. Wassermann negative. X-ray report July 25, 1920: Upper end of left tibia shows osteomyelitis with destruction of cortex of bone anteriorly.

Operation, July 29, 1920, Dr. J. H. Kite, resident surgeon. Removal of entire anterior half of the tibia from just below the upper epiphysis down to midway the leg. Pathological report of material removed was osteomyelitis with staphylococcus aureus in pure culture. Operation was followed by Carrel-Dakin treatment. Progress was apparently uneventful except the pulse rate remained high and granulation tissue grew very fast such that wound was frequently cauterized with silver nitrate. After 6 weeks (September 11, 1920) the granulation tissue was so abundant that it was removed with a curette down to the bone, the upper end of which was also curetted. Following this the temperature rose to 102° daily and the pulse was still rapid. She began to grow weaker, anæmic, and coagulation time increased to 10 minutes, tested because the dressings were associated with rather free bleeding. Two weeks later the granulation tissue was again overabundant and I was asked by the resident to see her. X-ray showed a large amount of bony production invading the soft tissues around the upper end of the tibia and seemed to be out of proportion to the amount of callus that would be expected. Sarcoma was strongly suggested. X-ray of the lungs was negative. A section was taken from the depth of the wound but showed only infected granulation tissue. This was repeated with the same findings. The general condition of the patient was poor, she was anæmic and weak, leucocyte count, 3,200, red blood cells, 2,640,000 and hæmoglobin, 35 per cent. We so strongly suspected sarcoma, even though the sections failed to show it, that I decided to explore, and this was done October 5, 1920. A tourniquet was placed just above the knee to prevent dissemination of sarcoma cells, if found. An enormous bulging overgrowth of granulation tissue was removed with the fingers and curette down to the bone. There was much slender striæ of bone formation, perpendicular to the shaft, throughout this, but the sarcomatous tissue was not encountered until the wound had been opened to the posterior mesial aspect of the tibia, where it was found in abundance. Fresh operative toilet (gowns, gloves, instruments, and dressings) was promptly made, an additional tourniquet placed high upon the thigh and a mid-thigh amputation done between the tourniquets.

Pathological report, Dr. R. V. Lamar: "Large round-cell sarcoma, apparently arising from the periosteum of the upper portion of the tibia and invading muscles and connective tissue (not the bone) upward into the popliteal space, extensive hæmorrhage, some necrosis, wide-spread infection (staphylococcus aureus) of the soft parts. Also osteomyelitis of the tibia way down the shaft below the limit of the tumor. Staphylococcus here also."

The immediate convalescense was satisfactory, with marked improvement in the general condition, and she was discharged from the hospital on the twelfth day.

Four months later there was a questionable infiltration of the left lung which was definite after a lapse of 2 months more—thus X-ray April 15, 1921: "Areas of density in the left base and right upper portion of lower (left) lobe—at least suggestive of

[1] Read before the Southern Surgical Association, Pinehurst, North Carolina, December 13–15, 1921.

recurrence of sarcoma in lungs." She escaped from our observation after this and the next we heard was of her death August [illegible] 1921 [illegible] months after amputation, 13 months after first symptom. The family, upon interview, gave history of her last illness which indicated that in all probability it was pulmonary metastasis.

Case 2. (Private.) Wilhenford Hospital No 7302, admitted March 15 [illegible] Miss S., age [illegible], white, had sarcoma of periosteal origin of the large round-cell type of left tibia. Family and past history were negative except for three miscarriages by her mother. She first noticed "growing pains" in the left tibia during February, 1920. Swelling appeared about July 1, 1920, and following this she began to have attacks of "hard pains" in the leg with drawing of the toes, duration 2 to 3 days. Some relief was obtained by hot moist applications. No loss of function except during the attacks. No history of trauma or of any serious illness. She was given antisyphilitic treatment with a presumptive diagnosis of syphilitic periosteitis, from July, 1920, until early in January, 1921. During the latter part of January she developed gonorrhœa for which she was treated by Dr. F. X. Mulhering with whom I saw her in consultation relative to the leg about March 1, 1921. Blood Wassermann was negative. Leucocytes 13,000 and hæmoglobin, 60 per cent. Chest, negative. Examination of the leg as noted below except that the growth was not quite so large, its progress had been very slow. It was diagnosed as probable sarcoma and careful study of an X-ray taken in December rather confirmed this opinion, and operation was advised. They procrastinated however, until, several days before admission to the hospital, there was a rather sudden and rapid increase in size which served to hasten her to the hospital.

Examination March 16, 1921. There is a fusiform swelling of the left tibia, mid and upper thirds, the largest diameter, 2 inches, at about the junction of these thirds. No tenderness, no loss of function, no involvement of knee or other joint. No elevation of surface temperature. It is quite indurated and apparently covered with bone. No pulsation. General examination otherwise negative. X-ray at this time taken in the University Hospital was reported as probable sarcoma of periosteal origin. There were two superimposed layers of bone (?) above the shaft with fine striæ of bone formation perpendicular to the shaft. X-ray of the chest was negative. No other bones taken.

Operation March 19, 1921. A tourniquet was placed just above the knee, the tumor explored and found to be sarcoma, verified by frozen section. Fresh operative toilet and a mid-thigh amputation done without removing the lower tourniquet. Convalescence was uneventful and she was discharged 3 weeks later.

The tibia was dissected out and the growth found to be fusiform, extending entirely around the tibia but thinnest on the posterior aspect. It was apparently perfectly encapsulated with no invasion into the surrounding tissues or into the bone, seemed rather to be superimposed upon the shaft of the tibia. Upon splitting it a small abscess was found in the medullary cavity with early necrosis of the canal mid-way the length of the tumor and staphylococcus aureus upon culture.

Subsequent history to date is uneventful, no evidence of recurrence local or otherwise. She has grown rapidly and added considerable weight.

Case 3. University Hospital No. 23341, admitted August 3, 1921. Julia M., age 20, negro, with periosteal, large round-cell sarcoma. Family and past history negative. No serious illness. Present illness began 3 months ago as a small lump on the anterior surface about mid-way the left tibia. Growth gradual for 2 months, but quite rapid during the past month, and she has had to use a strong stick in walking. Following the use of hot applications to try to lessen the swelling, it became ulcerated. She has never had any pain. Loss of weight has been rapid during the past month. Never any trauma.

Examination negative except as follows: the left inguinal glands and those in Scarpa's triangle were a trifle enlarged. There was a fusiform swelling of the middle third of the left leg, about three times the size of the right. The toes were dropped and the foot somewhat inverted, and a small ulcerated area over the anterior surface of the tumor. Some elevation of surface temperature but no tenderness upon palpation or manipulation, the latter reveals false motion in the region of the tumor. The growth is soft and nowhere suggests bony covering. Temperature upon admission was 102° and showed a daily range from 100° to 104°, the pulse rate, 110 to 135. Urine, blood and blood Wassermann were negative. Hæmoglobin, 90 percent.

X-ray August 4, 1921, reported "Osteosarcoma invading the middle portion of the left tibia. Fracture, transverse of the left fibula at the junction of the mid and lower thirds with callus formation and angulation." A small section was taken from the ulcerated area which was immediately cauterized with the electrocautery, this was reported as sarcoma.

Operation August 5, 1921. Dr. G. N. Coker, resident surgeon. Mid-thigh amputation. Convalescence was uneventful except for a low grade wound infection with bacillus pyocaneus. She was discharged September 15, with wound healed and general condition good. Temperature dropped to normal immediately after operation, the pulse rate more slowly.

Pathological report, Dr. R. V. Lamar: "Large round-cell sarcoma apparently periosteal origin and beginning at about the junction of the mid and lower thirds of the left tibia mesially, invading the bone and leading to fracture, and invading much more the soft tissues, extending out to the skin with ulceration, infection and sloughing: down to the inner malleolus and upward to above the middle of the tibia. Many mitotic figures. Much fine intercellular lime deposit with very early formation of new bone

[illegible] regularly." The lower portion of the tibia showed dense infiltration downward about 2 inches and below this, the growth extended subperiosteally to the lower border of the internal malleolus. The tibia above the fracture showed extensive necrosis and infection (staphylococcus aureus). The fibula was not invaded and the site of fracture seemed to be healing with normal callus. Recent [illegible] and examination shows her still in apparently good condition.

SUMMARY

1. The author reports three cases of large round-cell sarcoma, periosteal origin, associated with infection and necrosis of bone.
2. All females, two white, one negro.
3. Ages, 14, 12, and 20 years respectively.
4. Left tibia in each case.
5. No history of trauma or serious illness.
6. Local pain in two, none in the other.
7. Staphylococcus aureus infection in each.
8. Rapid pulse and rather high fever in two, none in the other.
9. Treatment, mid-thigh amputations.
10. Results, one dead, and two living free from signs of recurrence, local or elsewhere, to date.

CASE 1, developed in the hospital under our observation and we feel reasonably sure therefore, that the osteomyelitis preceded the sarcoma.

CASE 2, we questioned which preceded although we did not suspect the infection and necrosis or abscess prior to operation but found it upon dissection of the specimen. Might the history, however, of attacks of pain—"growing pains" for several months preceding the development of the tumor—suggest infection or abscess as the original?

CASE 3, gave an indefinite history and showed a well advanced growth when we first saw her. The specimen was interesting in that there was a rather sharp line of demarcation at the site of the pathological fracture of the tibia—extensive osteomyelitis of the shaft above, whereas below, there was wide-spread invasion by the sarcoma of bone and soft parts, extending downward even to the internal malleolus.

NOTE—August 21, 1922. Cases 2 and 3 are living and apparently in excellent health, free from any evidence of recurrence, at this time.

UTERUS SEPTUS DUPLEX, WITH FULL-TERM TWIN PREGNANCY

By CHARLES J. KICKHAM, M.D., F.A.C.S.

ANOMALIES in uterine formation, with subsequent pregnancy, are usually interesting to report and that the "double" type of uterus has some clinical significance goes without saying. The case reported below is unique, as a search of the literature for some years back does not reveal one of uterus septus duplex, where pregnancy took place in each half and went to term with living babies.

The various textbooks on obstetrics and gynecology contain a few pages on this subject and its etiology and anatomic types. Before going further allow me to review in brief a few of these points. Embryologically the vagina and uterus are formed by the fusion of the two muellerian ducts, and this fusion takes place from below upward. In anatomical studies of actual cases, it has been found that failure of this normal fusion has resulted in several varieties of abnormality, some little and some very greatly divergent from the normal condition. For instance, we get the case of double vagina, with normal uterus; the double vagina and cervix but single uterine cavity; the normal vagina and cervix but uterine cavity divided by a central septum; the uterus, two distinct portions, only joined low down at cervix (uterus diadelphus); the well developed uterus, with a rudimentary horn, and so forth, through other anatomical malformations.

In many of these cases no other abnormality is present and the local condition is only discovered by accident, since the patient is not cognizant of an unusual condition. Some degree of lack of fusion of the muellerian ducts is not uncommon as shown by the number of cases reported in journals as well as from my personal observation, and I wonder if it cannot account for some of the unusual obstetrical and gynecological conditions we meet from time to time. One book mentions that this may be the factor in a case of regular menstrual flow, accompanied by known pregnancy; the menstrual blood coming from the unimpregnated portion of the uterus; it may account for excessive menstruation at regular periods. Some of the aborted pregnancies in the early months may be due to the impregnation in a rudimentary portion of such a uterus and it may account for some of the other abnormalities. Impregnation with normal delivery has taken place with cases of such congenital abnormalities and the double vagina or "double" uterus only discovered later during some operation or on pathological examination of the uterus. Cases have been reported where a full-term pregnancy has taken place in one half and an undeveloped embryo or fœtus found in the other portion. One case is on record where a twin pregnancy had taken place in one horn of a bicornuate uterus and had calcified and remained for 20 years before discovery. It has been said that twin pregnancy may in some cases be due to this anomaly; each portion of the uterus being impregnated separately or by superfœtation but not in the same uterine cavity. My case seems to give proof of this. Before giving case history let me say that I regret exceedingly, owing to a preventable error, it was not determined in this case whether the vagina was single or double.

Mrs. Z., I-para, age 30; birthplace, Russia. Past [illegible] nothing important. The entire history in this case [illegible] h and the little obtained came through interpretation.

[illegible] but husband said she was due at this time. Patient [illegible] referred her at once to the hospital. General [illegible] tarted about 3 weeks [illegible] and patient became seriously ill with sympt[illegible] Jakmauh was called.

[illegible] pounds. She could not speak English but kept putting hand to head as though suffering from headache. Patient dull and semi-stuporous. Œdema more marked in face, limbs, and abdominal wall; all these regions more œdematous than the writer had ever seen. Tongue was covered with heavy brownish coat and thickened. There was a slight systolic murmur at apex transmitted upward; the borders of heart were not made out clearly. Pulse [illegible] and synchronous with heart beats.

The lungs showed nothing abnormal but breathing was of sterterous type and made examination difficult; no œdema of lungs was found.

Blood pressure: systolic, 196; diastolic, 140.

The abdominal walls were œdematous and a large uterus, consistent with full term, made out; no uterine contractions; fluid wave with question in abdominal cavity. Vulva very œdematous but no vaginal examination made. No fœtal parts or heart made out.

Operative record showed pre-operative diagnosis, toxæmia of pregnancy with impending convulsions.

Postoperative diagnosis, toxæmia of pregnancy plus uterus septus duplex.

Anæsthesia, ether, Sister Thecla; assistant, Dr. Nelson.

Operation. Through a median low incision the peritoneal cavity was opened with evacuation of large amount of clear, ascitic fluid; the uterus was opened in the median line in the lower segment; the membranes presented and ruptured and fœtus was delivered; cord clamped and cut and baby given to assistant; uterus emptied of placenta, membranes and clots. It was then noticed that uterus did not collapse as in the normal case after delivery of contents and exploration showed the uterus to be enlarged to right of present uterine cavity to about size of full-term pregnant uterus. I first thought I had to deal with a large fibroid and after suturing the uterine wound in layers in the usual way, I proceeded to remove a supposed fibroid. On cutting down to enucleate I opened into a cavity and membranes presented which were ruptured and disclosed a fœtus; child was delivered and cord clamped and cut and baby given to assistant. This uterine cavity was emptied of second placenta and membranes, and examination now showed a septum about one-half inch thick running from fundus down through cervix and completely dividing uterus into two distinct halves, though externally no point of division was noticeable. The second uterine cavity was sutured in layers without disturbing septum. Patient had been given ergotin subcutaneously as is the custom in our cases and did not bleed more than usual. All bleeding was controlled and the peritoneal cavity sponged clean and the peritoneum and abdominal wall closed in layers in usual way. The patient was returned to bed in good condition and made good operative recovery. Both babies in good condition: first weighed 6 pounds; second 6⅞ pounds; both females.

Postoperative record in brief: Toxæmic condition never seemed to improve and patient remained in semi-stuporous condition, running constant high blood pressure. During this time patient had some urinary suppression and catheter specimens showed constantly much pus, blood cells, and casts. On third day there was a small breaking down at lower end of incision with evacuation of seropurulent material. This cleared up on ninth day. During this time patient had no vomiting and kept down liquids; bowels moved with enemata and cathartics. On eleventh day postpartum patient had a typical uræmic type of convulsion and died in about 1 hour. No permission for autopsy was obtained.

CHOLECYSTENTEROSTOMY FROM AN EXPERIMENTAL STANDPOINT

By GATEWOOD, M.D., Chi[illegible]

and

PETER H. POPPENS, M.D., Princeton, Illi[illegible]

THE possibility of making an anastomosis between the gall bladder and some part of the gastro-intestinal tract was suggested almost as early as the operation of cholecystotomy. Nussbaum (1) is generally credited with first suggesting such an anastomosis. He did not suggest the present operation but stated that in cases where the flow of bile into the intestine was no longer possible, the question of an artificial stoma made by some adhesion between the liver and the bowel was one to be considered. In 1880 or 1881 von Winiwarter (2) performed the first operation of this type. He sewed the gall bladder and the ascending colon together and fastened them in the abdominal wound. Two attempts to establish connection by means of a trocar failed. Later a loop of small bowel was fastened to the gall bladder and a tube inserted. Four operations were required to close the fistula which followed, so that the patient had undergone at least half a dozen operations before the necessary anastomosis was completed.

In 1884, Gaston (3), of Georgia, experimenting upon dogs, fastened the surfaces of the gall bladder and duodenum together by means of a single elastic suture and relied on the formation of a fistula as the suture gradually passed into the bowel. In some of his dogs he found the fistulous opening persisted 3½ months after the operation in spite of the fact that the common duct was not ligated.

Harley (4) established a communication by applying a corrosive paste to the surfaces of the two viscera and rapidly uniting them by means of suture.

Golzi (5) opened both the gall bladder and the bowel and united them by two rows of sutures. This method is practical and safe and has served as a basis for subsequent operations.

In 1892, Murphy (6) advocated the use of his button instead of the sutures. This method was generally adopted for a time but has now been practically abandoned, although it can be used to advantage in well-selected cases.

Cholecystenterostomy in one stage was first done in man by Monastyrsky (7) in May, 1887, and about a month later by Kappeler (8). Both dealt with cases of carcinoma of the head of the pancreas. In each instance the gall bladder was united to the small intestine by means of two rows of sutures.

Mayo-Robson (9), in 1889, united the gall bladder to the colon with apparently good results. In 1902, Radsiewsky (10) was able to collect 56 cases of anastomosis of the gall bladder to some portion of the gastro-intestinal tract. Mayo-Robson (11), in 1909, reported 62 cases of cholecystenterostomy. In 49 of these there was benign occlusion of the common duct (chiefly interstitial pancreatitis) and in 13 the obstruction was due to malignancy. Of the former, 47 made a complete recovery, while of the latter only 7 survived the operation. In 1913, Kehr (12) reported that he had performed more than 60 cholecystogastrostomies with excellent results.

Although the establishment of a fistula between the gall bladder and some portion of the gastro-intestinal tract has become a recognized operation with fairly definite indications, there is still considerable difference of opinion as to what part of the canal should be used. Most men of experience prefer the duodenum as this more nearly restores normal physiological relations. Such an anastomosis, however, is not possible in many cases on account of adhesions, or, perhaps, the presence of a tumor. Where it is necessary to take some other portion of the gastro-intestinal tract, the stomach, jejunum,

ileum or colon may be used. Spontaneous fistulæ between the gall bladder and the colon have been found at autopsy and at operation in cases of cholelithiasis. Some of these cases have apparently done well for a considerable time. Mayo-Robson performed his first cholecystocolostomy upon a woman with a tumor in the gall bladder region. The duodenum was inaccessible on account of adhesions and the gall bladder was, therefore, united with the hepatic flexure of the colon. Although a fistula persisted for a few weeks the patient made a good recovery and was living 4 years later. In summarizing his experience, he stated that although the anastomosis with the colon had acted very well, he no longer thought it the safest operation because of the possibility of suppurative cholangeitis. This seems to be the general opinion of the men who have had the largest experience with this type of operation.

Cholecystogastrostomy, first reported by Wickhoff and Angelberger (33), then for a time advocated only by the French (Perrin, Jaboulay, Terrier, and Lejars), seems to be gaining in favor at the present time. Hans Kehr, in urging it, claims that there is less danger of infection and more accessibility. He states that most of his patients never vomited and soon had a good appetite. He believes that the danger of an ascending infection is present in any anastomosis, but that the stomach is least likely to give trouble. In more than 60 cases in the 10 years prior to 1913, he noted liver infection in but one instance.

Many surgeons have hesitated to anastomose the gall bladder to the stomach because they have feared that the bile might disturb the chemistry of digestion. The older physiologists (Claude Bernard, Schiff, and Hammerstein) showed that bile *in vitro* delayed digestion. This was believed to be due to a precipitation of pepsin and peptones. These men taught that bile in the stomach had a harmful influence upon the organism. That quite different conditions prevail in natural digestion was early shown by A. Dastre (13) and Oddi (14). Dastre in 1880–1883 gave bile to dogs at intermittent periods, either by mouth or by gastric fistula, and showed that the animals did well under these conditions. He also showed that, when the bile was introduced into the stomach during digestion, the gastric contents remained acid and contained pepsin and peptones. Oddi, in 1887, both by feeding experiments and by anastomoses showed that in dogs, bile entering the stomach did not disturb the digestive process nor interfere with the general health of the animal. Paterson (15) states that in gastrojejunostomy the total gastric acidity is reduced 30 per cent, due partly, he believes, to the entrance of bile and pancreatic juice and partly to the diminution of the total chlorides secreted by the gastric mucosa. Employing dogs, Wiedemann (16) made fistulæ of the stomach and of the bowel at the junction of the jejunum and ileum. Control tests were made for 4 weeks, after which cholecystogastrostomy was performed. He found that on a milk diet, the addition of bile did not reduce the acidity of the stomach contents. There was some decrease in the splitting of albumin due perhaps to the absence of the usual regurgitation of pancreatic juice with the bile. The amount of undigested food in the intestinal contents was found to be less. Masse (17) kept dogs with cholecystogastrostomies alive for 9 months or more and reported that they remained perfectly healthy. Cannac (18) has confirmed these observations.

A number of men (Monprofit, Kausch, and Speed), owing to the accessibility of the jejunum, have advocated its use for anastomosis. Pendl (24) first performed a cholecystenterostomy through a slit in the mesocolon (cholecystenterostomy retrocolica). Krause (25) then combined a cholecystenterostomy with an entero-anastomosis. Krukenberg (26) turned the fundus of the gall bladder 270° on its long axis, thus converting it into a screw-shaped passage. Monprofit (27) sectioned the jejunum and sutured the end of the distal part to the gall bladder, the proximal end being anastomosed to the side of the distal portion, thereby producing a Y-shaped affair. Kausch (28) modified Monprofit's operation by forming a narrow passage out of that part of the bowel attached to the gall bladder.

Fig. 1.—Cholecystoduodenostomy. Dog No. 4. The wall of the gall bladder and the ducts are greatly thickened. Notice the tendency to rugæ formation. This dog was killed 60 days after operation.

He inserted a rubber tube and narrowed the bowel over it by a continuous stitch. Von Bardeleben (quoted by Kausch) attempted to lead the gall bladder obliquely through the bowel wall as in the Witzel method of gastrostomy. These modifications on the whole are too time-consuming for clinical purposes and have not been of sufficient value to warrant their general adoption.

Of far more importance than any digestive disturbance is the likelihood of an ascending infection of the bile passages and liver, owing to the new avenue of entrance for organisms from the gastro-intestinal canal. The ampulla of Vater is an effective barrier to all foreign bodies, such as bacteria-laden food particles. Netter (19) and others have shown that the portion of the common duct next to the ampulla contains micro-organisms, although the gall bladder and liver apparently are normally sterile. The fact that the micro-organisms circulating in the blood are eliminated by the liver (Biedl and Kraus, 20) leads one to conclude that the bile passages are so constructed that they can harbor bacteria at least for a time, without suffering any marked pathological change. A different state of affairs is produced, however, when a direct communication is established between the gall bladder and the gastro-intestinal canal. It is here that the character and number of micro-organisms at different levels of the intestinal tract seem to be factors in the relative safety of the various anastomoses. It is generally known that the number of bacteria increases from the duodenum down to the sigmoid. It is also well known that the gastric juice exerts a destructive influence on bacteria, but many are unaware that the count in the stomach is higher than in the duodenum (Gilbert and Dominici, 21). The colon bacillus, which is

Fig. 2. Cholecystogastrostomy (Dog No. 8). The dilatation of the cystic duct and shrinkage of the gall bladder are quite evident. A thread is still attached at the line of anastomosis, but there is no evidence of ulcer formation. The stump of the common duct has atrophied. (This dog was killed 8 months after operation.)

one of the chief offenders in inflammations of the bile tracts, is, however, less common in the stomach and duodenum and rapidly increases in numbers from the duodenum down. One of us (22) has found that in fasting dogs organisms are constantly present in both the stomach and duodenum; also that streptococci are relatively infrequent and colon bacilli are not at all common in the stomach though frequently found in the duodenum.

Among the earliest clinicians to recognize the danger of ascending infection following cholecystenterostomy was Dujardin-Beaumetz (23) who noted in one case the clinical picture of "intermittent hepatic fever" described by Charcot. Kehr also has advised that the use of the operation be greatly limited on account of the danger of bacterial infection. Murphy (6), in 1892, reported that in experimental work with his button, a flap of mucosa covered the fistulous opening, allowing the bile to flow into the intestine but preventing the intestinal contents from escaping into the gall bladder. Nevertheless, isolated cases of infection have been reported following the use of the button and various other operations advocated as a result.

The first piece of experimental work done to determine the changes in the liver and bile passages following cholecystenterostomy was done by Radsiewsky (10). He doubly ligated the common duct, cut between the ligatures, and united the gall bladder to the duodenum. Five of his dogs survived the operation and were killed from 30 to 75 days later. From his experiments he drew the following conclusions: (1) dilatation and hypertrophy of the bile passages occur; (2) there is a thickening of the mucosa resulting from new gland and lymphatic follicle formation; (3) mild desquamative catarrh of the intrahepatic bile passages occurs; (4) invasion by bacterial flora into the liver parenchyma results. He believed that cholecystenterostomy itself carried with it little likelihood of infection of the bile passages and liver, but that invasion of the gall bladder with retained intestinal contents was a distinct menace and was likely to be followed by an ascending infection. Hubicki and Szerszynski (29) operated on seven dogs, some of them by Monprofit's and others by Krause's method. At the end of a year, they found suppuration in the bile passages and liver in four of their animals. They believed that the negative results Radsiewsky obtained in some of his animals were due to the fact that they were not allowed to live long enough. Mocquot (30), in 1913, reported the findings in one dog with a cholecystoduodenostomy killed a year after operation and in another dog with a cholecystogastrostomy killed at the end of 4 months. His bacteriological findings in the two cases were practically the same, the livers being sterile, the common ducts containing a few organisms and the gall bladders many. Microscopic examination showed the bile passages and the liver in the duodenostomy practically normal except for a slight increase in the connective tissue. In the gastrostomy there was a marked increase in the connective tissue.

The results obtained experimentally would at first hand seem to contradict those obtained clinically. The large series of cases of Mayo-Robson (11), von Bardeleben [illegible] Kehr (12), and others with few reported liver infections has placed the operation among

[illegible] Note of the hepatic ducts. The pancreas was swollen in this case. While the liver showed no gross abscesses, micro-[illegible]

those regarded as relatively safe. On the other hand, evidence that no infection occurred is incomplete in many cases. Often the patients died of malignancy soon after the operation. In cases of chronic interstitial pancreatitis, the persistence of the stoma might be questioned. No doubt the bile resumes its normal course as soon as the pancreatic obstruction is relieved. It is probably then a question of but a few weeks or months before the fistulous opening has closed. (This is what happened in Dog 8 in our experiments.) The severity of the infection also may be a factor in its clinical recognition. A low-grade hepatitis may be present for a long period without producing marked symptoms and it is only by a careful microscopic examination that the amount of damage done to the liver can be determined. This was demonstrated repeatedly in our experiments and has been shown by Graham [illegible] in his clinical work.

It is still an open question as to what type of operation is least likely to be followed by an ascending infection of the bile passages and liver. It was in the hope of obtaining a little light upon the relative safety of the various gall-bladder anastomoses that our series of experiments was performed

Fig. 1.—Microphotograph (for poster) to show line of union between stoma and gall bladder. Dog No. 18. Note lack of inflammatory reaction about suture. This dog was killed 5 months after cholecystogastrostomy. *a*, Cross section of thread; *b*, muscularis of stomach; *c*, gastric mucosa.

and while the results may not be conclusive, we believe they demonstrate some facts of clinical importance.

METHOD

Our experiments have consisted in making 42 anastomoses in dogs. The animals, which had been starved for 14 hours, were operated upon under ether anæsthesia. A high right rectus incision was made. Cultures were made from the gall bladder, liver, and from the portions of the gastro-intestinal tract used for anastomosis. Grossly, all livers appeared normal at the time of operation, and sections taken in a number of instances were entirely negative. The common duct was then doubly ligated and cut, except when otherwise stated. The gall bladder was united to the stomach or intestine by two rows of continuous Lembert sutures of silk or linen, the upper row uniting the serous membrane and the inner passing through all the layers. Great care must be taken with hæmostasis as several fatalities occurred from hæmorrhage into the gall bladder. The abdominal incisions were all closed without drainage.

In the first six dogs the common duct was not obstructed and somewhat to our surprise the anastomoses practically closed just as a gastro-enterostomy stoma frequently closes when the pylorus is unobstructed. In one case (Dog 13) the common duct was simply ligated with a piece of heavy thread. Thirty-two days later the lumen of the duct had been restored and the cholecystogastrostomy stoma was so small that only the finest probe could be passed through it. In all other cases the same technique was employed; that is, the common duct was isolated, doubly ligated and divided, allowing the two ends to retract. In some instances a portion of the duct was resected.

Of 20 cholecystogastrostomies, 17 duodenostomies, and 5 colostomies, 2 gastrostomies, 1 duodenostomy, and 1 colostomy died either during or immediately after operation. Four cholecystogastrostomies, a like number of duodenostomies, and 3 colostomies were killed or died on account of peritonitis.

Owing to the length of this paper, protocols of the individual experiments have been omitted and a simple statement of the results given. Cultures made from the gall bladder were sterile, both in aerobic and anaerobic cultures, in 41 of the 42 dogs. A few colonies of the staphylococcus albus were found in one instance — almost certainly a contamination as this organism is usually found in the skin. Cultures made from the liver were sterile in 32 out of 37 examinations. (No cultures were made in 5 dogs.) Staphylococcus albus in pure culture was found in two instances and various contaminations, mostly hay bacillus, were found in the other three. It is quite probable that all livers were sterile, but that they were contaminated by using the same knife which was employed in making the peritoneal incision. Cultures were uniformly negative after taking the precaution to employ a new knife for the removal of the tissue.

Four of the cholecystoduodenostomies were killed at 10, 36, 66, and 300 days. Seven stomach anastomoses were killed at 2, 6, 8, 35, 75, 129, and 166 days, and three cholecystocolostomies at 1, 2, and 5 days. While it was the purpose of our experiment to keep the dogs much longer, this was not practical on

account of the housing conditions, and because some of the dogs developed distemper. *In every instance, whether the animal lived 1 or 300 days and regardless of the viscus employed for the anastomosis, the gall bladder was infected.* Grossly, in all cases living more than a month, the mucosa was thickened and white (Fig. 1). In the older cases, the gall bladder became narrowed and the stump of the common duct which was dilated in the earlier cases atrophied so that a probe could scarcely be passed down it. No evidence of ulcer formation was seen at the line of anastomosis although the threads were found loosely attached in many of the older cases (Fig. 2). A number of the older dogs died of worms, and round worms could be found obstructing small intrahepatic ducts which would barely permit of their entrance (Fig. 3). Hairs were found in the smaller hepatic ducts a number of times.

bile ducts; *c*, liver parenchyma.

Microscopically, the mucosa of the gall bladder was inflamed, thickened, and frequently there was a tendency to villous formation. The mucosa and submucosa contained collections of round cells, and the muscularis was infiltrated in most of the cases. The line of anastomosis usually was a narrow strip of scar tissue. Sometimes, the silk or linen suture could be demonstrated, usually with very slight reaction about it (Fig. 4). The findings in the liver varied greatly depending upon the amount of cholangeitis. In some cases there was nothing more than a slight cloudy swelling. In one cholecystogastrostomy killed 129 days after operation, there were no changes noted in the liver in spite of the fact that both colon bacilli and other organisms were recovered bacteriologically (Dog 14). In all of the other dogs which survived any great length of time, a definite increase in the connective tissue about the ducts occurred, and in some cases this was quite marked as early as 66 days (Fig. 5). Although a round-cell infiltration was frequently found in the interlobular septa, no definite abscess formation was found except in two dogs. (One duodenostomy killed in 10 days showed some necrosis in the center of the lobules. Another killed at the end of 300 days had developed an abscess between the liver and the gall bladder.) In no instances in our series were multiple intrahepatic abscesses found.

Bacteriologically, the gall bladders contained many and varied organisms, including chiefly the colon bacillus, the staphylococcus, and numerous anaerobes. Yeasts and fungi were not uncommon. The livers in the cholecystogastrostomies were sterile up to 35 days. The duodenostomies killed at 10, 36, and 66 days likewise had sterile livers, but the dog killed at 300 days had a colon and staphylococcus infection in the liver cultures. Two cholecystocolostomies killed 1 and 2 days after operation had infected gall bladders. The other three cholecystocolostomies died of infection, or were killed *in extremis*. Fæcal matter was found in the gall bladder in every one of these cases, and it seems almost certain that all colostomies would sooner or later develop hepatic infection.

It is very difficult to prevent leaks and peritonitis when the colon is employed, while no difficulty was experienced with the other anastomoses. This I believe is due in part to the peculiar nature of the flora of the colon and partly to the short large bowel of the dog which prevents anastomosis without tension.

CONCLUSIONS

From the foregoing experiments performed upon dogs in which the gall bladder was anastomosed to the stomach, duodenum, and colon, the following conclusions may be drawn:

1. The gall bladder invariably becomes infected regardless of the viscus used for anastomosis.

2. There is little, if any, difference between the stomach and duodenum in the matter of rapidity of infection.

3. The colon is not the portion of the gastro-intestinal tract to be chosen by preference. The immediate dangers of peritonitis are much greater, and probably liver infections would occur earlier than when the upper part of the gut is used.

4. All livers become infected sooner or later if the method employed in our experiments be followed.

5. Cholecystenterostomy, from an experimental standpoint, is not an operation to be recommended for use except in well-selected cases, such as carcinoma of the pancreas where the temporary comfort of the patient is paramount, or irreparable common duct obstruction.

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UNUSUAL CASE OF SARCOMA OF THE MEDIAN NERVE

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THE patient was 40 years of age, American, and unmarried. She had been well until about 5 years ago. At that time she noticed a small swelling in the anterior surface of the right forearm, midway between the wrist and elbow, which was not painful or tender, and which remained practically constant in size. Five weeks before admission to the hospital, her right forearm began to swell in the region of the tumor, and this continued until the circumference of the right forearm was half again as large as the left and the patient suffered considerably from pain in the right forearm and hand, especially at night.

Physical examination showed nothing abnormal in chest or abdomen. The kidneys were normal as to microscopic examination and functional test. Blood Wassermann test was negative. Leucocytes 9,500, hæmoglobin 70 per cent. There was very slight diminution of function over distribution of median nerve but not sufficient to be noticed by the patient.

Operation was done May 31, 1921. An incision was made along the anterior aspect of the right forearm, exposing the flexor tendons. There was a large mass about 8 inches in diameter, which was apparently connected with the median nerve. The median was divided at either end of the tumor, leaving a gap of about 9 inches of nerve, and the mass removed.

The following is the report from the pathological laboratory: Grossly the specimen is a sausage shaped, symmetrical mass about 15 centimeters long and averaging 4½ centimeters in diameter. It was rather firm in consistency and of a pinkish-grey color. From the upper extremity is seen projecting the nerve trunk, the sheath of which evidently forms the capsule of the tumor. The gross appearance of a cross section through the middle of the tumor mass shows irregular circular markings, suggestive of capsules of nerve bundles into which tumor cells have penetrated.

Microscopic slides were made from sections of the lower pole of the tumor mass, from the middle and also from the nerve trunk emerging from the tumor. Microscopic examination of the sections from the lower pole gave a typical picture of the so-called neurofibroma, and its close association with the nerve sheath leads one to the conclusion that the original tumor arose from this structure. Examinations of the sections from the central portion of the tumor shows it to be made up of very rapidly growing cells, irregular in shape and size with definite vesicular nuclei and many typical mitotic figures. Giant cells, both mononuclear and multinuclear, are to be found scattered about throughout the field. The predominating cell is of the spindle type. Dilated capillary vessels with distinct walls are widely distributed throughout all the sections. Preparations through the nerve trunk show in a majority of the bundles a marked fibrosis with atrophy of the nerve fibers. In some of these there was marked infiltration of rather regular spindle cells with oval vesicle nuclei and showing but few mitotic figures. This is evidently an extension of the tumor mass up through certain nerve bundles.

Histological diagnosis: A rapidly growing, irregular, spindle-cell sarcoma, originating in a neuro fibroma.

The wound healed by primary union. It was surprising to see the amount of function still present in the flexor tendons,—apparently through the ulnar distribution to the flexor profundis digitorum.

August 2, 1921 (5 weeks after operation), patient returned with a similar swelling at the site from which the tumor had been removed. Thinking it might be a blood clot, a small incision was made into the mass,— but it was entirely a return of the sarcoma.

Amputation of the arm was advised but the patient refused, and she was treated with X-ray and radium. The tumor continued to enlarge and one month later she was again urged to consent to an amputation of the arm, but she wished to interview relatives in Cleveland, Ohio, before consenting to another operation, and was referred to Dr. George W. Crile.

She received additional X-ray treatments while

Fig. 1. Gross specimen removed.

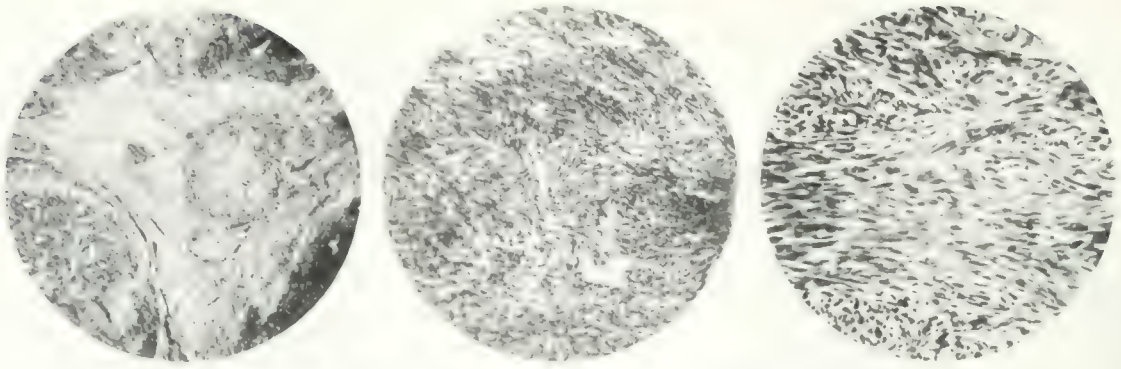

Fig. 2. Photomicrographs of specimen showing spindle-cell structure of tumor.

under Dr. Crile's care but the progress of the growth was not checked, and on October 17, 1921,— a little over 3 months after the first operation,— the arm was amputated at its middle, by Dr. Crile.

Frozen section diagnosis at that time was mixed cell sarcoma.

In a review of the literature extending back several years, there have been found only two cases of neurosarcoma reported. In one paper, published by McArthur in the *Surgical Clinics of Chicago* for February, 1920, there is described a neurosarcoma of the posterior tibial nerve which was completely removed at operation but which required a subsequent removal of the retroperitoneal lymph nodes where metastases from the nerve tumor occurred. Max Minor Peet, in the *Journal of the Michigan State Medical Society* for July, 1917, reports a case of spindle-cell sarcoma arising in a cavernous lymph and hæmangioma of the musculospiral nerve. In this case the tumor was removed, with part of the nerve, and the nerve ends sutured. Two months after the operation there was no recurrence of the growth, and the patient had excellent use of the arm and hand except for a wrist drop.

A number of the textbooks on pathology mention neurosarcoma, and L. Aschoff in his *Pathologic Anatomy* for 1921 characterized true neurosarcomata as being of very rare occurrence. Keen's *Surgery* reports sarcoma occurring in the posterior tibial, popliteal, and peroneal nerves.

The case we are reporting is interesting for the following reasons: (1) its unusual size; (2) its prompt recurrence; (3) its marked resistance to X-ray and radium; (4) the rather positive evidence of its developing from an innocent neurofibroma.

HYDATID CYSTS OF THE HEART, WITH REPORT OF CASE

BY H. W. MILLS, M.R.C.S. [illegible] L.R.C.P. [illegible] L.A.C.S. [illegible]

I AM able to report this case through the courtesy of Dr. A. F. Wagner, in whose official practice, as coroner's physician to the city of Los Angeles, it occurred.

Case J. G., Frenchwoman age 36, found dead.

Postmortem, January, 1921. Heart [illegible] the right ventricle 5 centimeters in diameter. Typical laminated cyst wall. No daughter cysts or scolices. Lungs: right lung [illegible] four cysts size of walnut in [illegible] lower lobe in substance of lung. Left lung normal.

Pathological report (Drs. Brem and Zeiler): At the apex of the right ventricle is a rounded prominence about 4 centimeters in diameter. In the interior of the ventricle the apical portion is narrowed by a mass lying in the apex and pushing upward and inward the [illegible] of the interventricular septum. Section of this mass reveals an oval cyst 5 by 4 centimeters; attached to its wall is a wrinkled, folded membrane which is more or less translucent. The cardiac tissue covering the cyst is little more than the endocardium. The left ventricle is of normal size and not invaded by the cyst.

Microscopic examination. Section from the wall of the cyst shows an eosin-staining, lanceolated membrane without nuclei and outside this a fibrous, connective-tissue capsule; about this is a zone of inflammatory infiltration containing a few round cells and great numbers of eosinophilic leucocytes. Diagnosis: echinococcus cyst of heart.

Extract from Dr. Wagner's letter: "I believe the process started in the lungs and infected the heart by direct extension."

I believe, on the contrary, that the case was one of primary echinococcus cyst of the heart with secondary metastatic infection of the right lung. In the first place the relative size of the cysts points in this direction. I am aware that the age of an hydatid cyst of the lung cannot with certainty be estimated by its size (Dévé estimates it as the size of a nut in 2 years). Nevertheless it must be remembered that a secondary cyst of the lung may be actually larger than the original heart cyst, for the former grow relatively more quickly owing to their non-resistant environment. Dévé mentions a case where the primary heart cyst was the size of a pigeon's egg and the secondary lung cyst as large as a hen's egg.

In this case, as a matter of fact, the heart cyst was larger than any of the four lung cysts. Though the heart cyst here contained no daughter cysts or scolices, yet its nature was proved by the typical laminated structure of the cyst wall, and the cyst itself was obsolescent.

The situation of the lung cysts, four in number, all together and contiguous to the heart (so much so that Dr. Wagner suggested "direct extension" from one to the other) immediately suggests their development as a colony from four scolices in the same brood capsule.

Multiplicity of cysts of the lung (more than two or three) suggests in itself their secondary origin; so also does their relatively cortical position, though it has been noted that metastatic cysts of the lungs may be occasionally central. One may mention here incidentally that whereas secondary metastatic echinococcosis of the lungs (which has never yet been diagnosed during life) is fatal, primary parabronchial hydatid cysts of the lung show spontaneous cure by vomica in 80 per cent of cases.

The picture is not as typical as that in Grulee's case, for there the metastatic lung cysts were bilateral (as they are as a matter of fact in 85 per cent of cases, though in three reported cases they were definitely stated to be unilateral), and the heart cyst contained daughter cysts—an evidence of age or previous rupture. Nevertheless my explanation is practically certain to be the correct one, as the converse—a secondary heart cyst from a primary lung cyst—is impossible; the pulmonary filter is permeable to the hexacanth embryo of 36 microns diameter, but not so to the scolex which is five or six times larger. The obvious difference in their age and the fact that no hydatid cyst obtained in the liver, precludes the idea of multiple contemporaneous primary cysts from massive infestation. In some cases the parent cyst in cases of metastatic echinococcosis of the lung has been located in the liver and the iliac bones, but in 75 per cent of such cases the right heart is found to be its seat. In echinococcosis hydatidosus, infection by direct extension does not obtain; the hexacanth

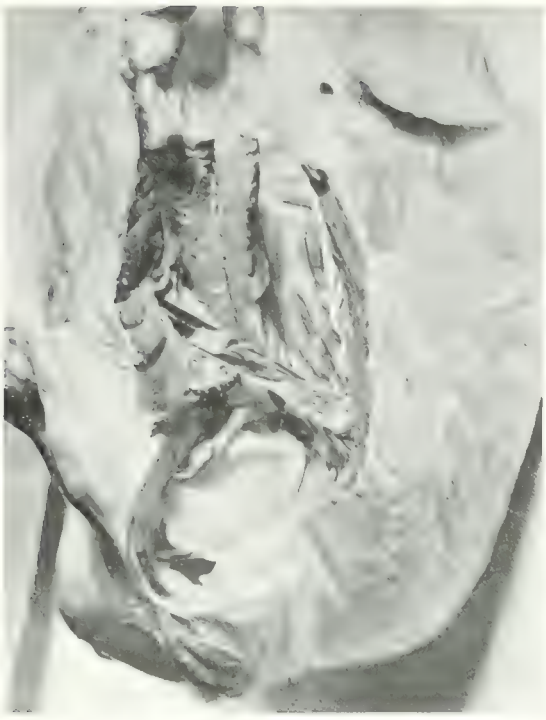

Fig. 1.—Hydatid cyst in apex of right ventricle of heart. Illustrates the case reported in this article — that of Dr. A. F. Wagner of Los Angeles, California. Postmortem specimen from a Frenchwoman age 36 who died suddenly.

embryo travels via the blood stream: the cross-country-like-a-pack-of-hounds theory is obsolete. The lymphatic route is unproven.

The embryos can and do traverse both the hepatic and pulmonary filters: 75 per cent of them are arrested in the former and 10 per cent in the latter, leaving only 15 per cent to develop into primary cysts elsewhere in the body.

The usual course of events in such cases as these is as follows: a primary hydatid cyst of the heart results from an embryo which has surmounted both the hepatic and pulmonary fences. This cyst, because of its uneasy location, ruptures early. This primary rupture is *not* usually fatal, and, as a matter of fact, passes unnoticed. Secondary metastases of the lungs or brain, as the case may be (right or left heart), result from the flooding of the venous or arterial circulation with hydatid sand, i.e., brood capsules and scolices. No case of hydatid cyst of the heart has ever been diagnosed in a living subject, though Cerné once rightly suspected one. The X ray will, sooner or later, wipe out this reproach. In this connection it may be well to note that whereas various cardiac murmurs have been noted in some of the cases reported, such lesions are usually "silent." Arnould particularly in his article on the syncopal form of pulmonary echinococcosis draws attention to this fact, thus, "No hæmoptysis, expectoration of pus or hydatids, cough or dyspnœa: *and no particular cardiac symptoms*. Syncopal attacks recur without apparent cause; these crises somewhat resemble epilepsy. Sudden death occurs and the autopsy reveals metastatic pulmonary hydatid cysts *plus a latent heart cyst*."

In the meantime, while the metastatic cysts are developing, a change occurs in the parent heart cyst, which now becomes multivesicular—a purely defense reaction. Sooner or later a secondary rupture occurs. The primary rupture passes unnoticed because the elements set free are microscopical. The secondary rupture is immediately fatal in the great majority of cases from gross, massive, brutal embolism (daughter cysts, membrane, etc.) of the pulmonary artery or brain. In the case of the pulmonary artery, the five known exceptions are the cases reported by Andral, Budd, Wanderlich, Letten and Chiari, in which death was deferred for several months. Such is the graphic picture—and we are indebted for it to F. Dévé.

That spontaneous cure of hydatids of the heart does occur occasionally we know from the cases cited by Coote, Rokitansky, Goodhart, Habershon, and Madelung.

In North America this is the third case of echinococcus cyst of the heart which has been reported. The first was Grulee's (Italian female, age 17) in 1905. The second was reported by Davis and Balboni under the title of "hydatid cyst of the brain" (case 26) in 1917. Lyon's statistics, which included the earlier ones of Osler and Sommer, and appeared in 1901, contained no case of echinococcus disease of the heart. Most of the cases reported throughout the world have been in young subjects, average

age 23, though Klehmet's and Grulee's were aged 27, Rose's aged 30, and the oft-quoted one of Bernheim, 67.

HISTORICAL

Hydatid cysts of the heart were reported in the 17th and 18th centuries by Thebesius, Rolfincke and Fanton, and at the beginning of the 19th century by Portal, Dupuytren, Meckel, Price, and Morgagni. All these cases are dubious as the word "hydatid" had then a very vague significance.

The first paper of any importance was that of Davaine who collected 15 cases of [illegible] (some of these were cases of cysti[illegible]).

In 1838 Budd reported [illegible] case of a female aged 23: here during life a cardiac murmur obtained and postmortem a [illegible] full of daughter cysts was found projecting into the right ventricle; the right auricle and right ventricle were full of blood clot; a small vesicle was found free under the tricuspid valve and several in the pulmonary art[illegible] Davaine and Thomas).

In 1860 Wilks published a case [illegible] of Deptford, a medical pat[illegible] 19, in which an hydatid cyst [illegible] found free in the left ventricle, in the wall of which the parent cyst had developed: an hydatid cyst of the liver also obtained. (Cit. Davaine, Thomas, Bobowicz and Vegas and Cranwell.)

In 1864 Cobbold in a review of 136 English cases found the eight following cases of hydatid cyst of the heart

T. Trotter — 1796 (regarded as doubtful by Davaine).

D. Price — 1822, male age 10 (obs. xi of Davain[illegible]

R. Smith — 1838, cyst [illegible] block the pulmonary artery (Smith and Broderibb—Davaine obs. viii).

H. Coote (of Barts) 2 cases: one a dissecting room subject in which an hydatid cyst of the wall of the left ventricle had undergone spontaneous cure (compare [illegible] Rokitansky, Goodhart, Habershon, and Madelung).

Cases of Budd and Wilks, above referred to.

Vines — 1845, autopsy [illegible] suddenly. An hydatid cyst of the liver had ruptured into the inferior vena cava with resulting hydatid emboli of the right heart and pulmonary artery.

In 1868, Oesterlen reported a case of hydatid cyst [illegible] left auricle which had perforated the cavity, releasing many daughter cysts with resulting hydatid embolism of the common iliac and deep femoral arteri[illegible]

In 1872 L. de Welling of Paris published his thesis based on 30 collected cases. His list was not complete, Davaine's and Charcot's, 1862, case among other[illegible] omitted; also many of his cases are very dubious, i.e., Trotter, Dupuytren, Rutty, Morgagni (cysticercus), Otto, Andral (cysticercus), William.

In 1877 Neisser's paper appeared containing rep[illegible] 29 cases.

In the same year Davaine published his *Traité des Entozoaires* in which hydatid disease of the heart and vessels is fully dealt with. He gives many case reports, including that of Herard [illegible] lets and in whose interventricular septum were found, postmortem, 12 hydatid cysts.

Fig. 2. Hydatid cyst in wall of left auricle of heart [illegible] by James Graham, and reproduced here by per[illegible]

[illegible] Barclay whose patient was a sailor age 26 — incidentally hydatid disease is very rare in sailors (Budd) — in whom one of several hydatid cysts of the heart had ruptured into [illegible] sts had perforated on the left side and had caused [illegible]

[illegible]ler's case (Davaine obs. 19 ter) may also be mentioned—a boy age 15 whose heart was larger than a child's head and bosselated. Postmortem, multiple hydatid [illegible] found. One was attached to the right auricle and pulmonary artery: many daughter cysts: hydatid embolism of left renal artery. This case is cited by Welling.

[illegible] only was affected, and in 17 cases multiple hydatid cysts obtained elsewhere. He mentions Otto's (dub[illegible] which an hydatid cyst of the left auricle ruptured and [illegible] a daughter cyst the size of a walnut which blocked the auriculo-ventricular orifice with fatal result.

[illegible] Corneau) two hydatid cysts the [illegible]

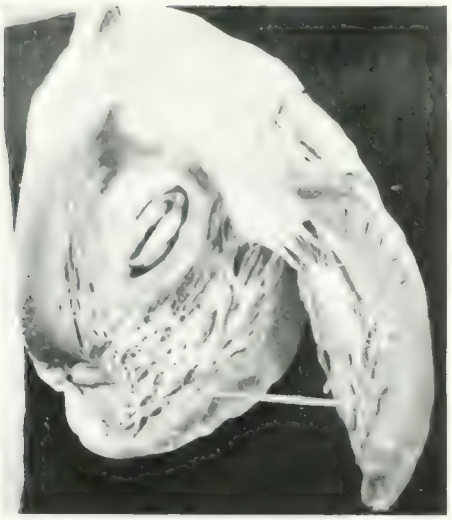

Fig. 3. Hydatid cyst in interventricular septum. Taken from "Hydatid Disease in Australia" by Professor A. Watson, Surgery, Gynecology and Obstetrics, 1907, iv, 5.

In 1891 Graham mentions the following cases:

1. Hydatid cyst of left auricle in a man who dropped dead while at work. Numerous daughter cysts obtained and the cyst had ruptured into the pericardium. A photograph of this specimen is here reproduced by permission of the publishers.

2. Boy with hydatid cyst of right ventricle blocking the pulmonary artery: sudden death. Reported by Bird of Australia, 1873.

3. Boy aged 18 with hydatid cyst of the right ventricle. Reported by Peacock and Hicks from St. Thomas' Hospital, London, 1864. Daughter cysts and multiple liver and abdominal cysts also obtained. This case is cited by Welling, Davaine, Thomas, and E. Dévé and M. Bopp.

4. Hydatid cyst in apex right ventricle size of hen's egg and full of daughter cysts. Reported by Stirling and Allen of Australia, 1879. Cited by Thomas.

5. Museum specimen from Sydney, Australia, of hydatid cyst of the interventricular septum, occupying ¼ of the original space of the left ventricle.

6. Boy — hydatid cyst of right ventricle, pulmonary artery blocked, sudden death. Smith and Broderibb, Lancet, 1837–8, p. 628. Cited by Davaine and Thomas.

It will be noted that in cases 1, 3, and 4 daughter cysts obtained, i.e., that a previous rupture had probably taken place.

Cases 2 and 3 were in young lads as is usual, but case 1 was definitely stated to have been in an adult man.

Coming now to the present century. Hydatid cysts of the heart are rare, obtaining as they do in less than 2 per cent of all cases of echinococcosis: contrast liver 75 per cent and lung 10 per cent.

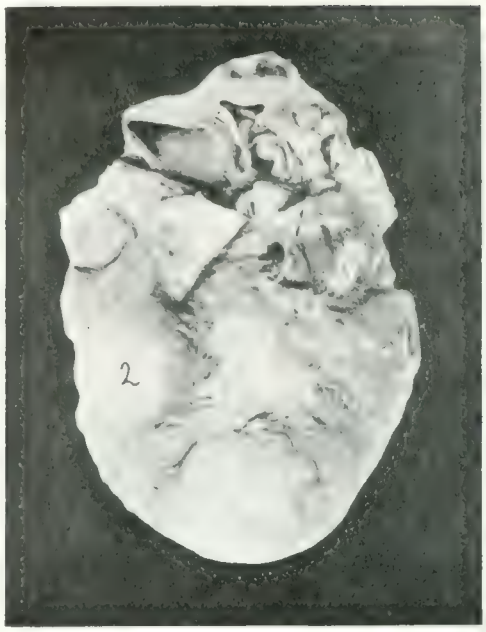

Fig. 4. Two hydatid cysts of the heart, one in the left auricle and the other in the right auricle. From *Los Quistes Hidatidicos en la Republica Argentina* by Vegas and Cranwell, published by Coni Brothers, 1901.

Vegas and Cranwell report one among their 970 cases, in 1901. They mention that 48 cases obtained in literature up to that time (i.e., the 48 cases tabulated by Thomas). Their own case was that of a man with multiple hydatid cysts in various organs. Postmortem were found an hydatid cyst of the left auricle the size of a hen's egg and a cyst of the right auricle, rather larger.

In 1903 Calvert reported an hydatid cyst of the heart (obs. 11 of Dévé and Bopp). The case was that of a girl age 22 who entered hospital June 6, 1903, and died July 23 of the same year. There was a history of hæmatemesis and she had been treated for gastric ulcer. Cough and dyspnœa had obtained for 6 months. On June 23 she expectorated hydatids, a systolic murmur obtained, also râles in both lungs. On June 26 she had an attack of hæmoptysis and the temperature rose to 101.2° F. On July 14 an erythematous eruption appeared on the chest and pleurisy was found to obtain (this according to Finsen means opening of the cyst into the pleura). A marked to and fro murmur was also noted. July 22 operation by Turner. Resection of the ninth right rib; tumefaction felt in center of lung: latter sutured to the surface and wound packed. July 23 died from syncope. Postmortem: heart — hydatid cyst slightly smaller than a golf ball in apex of right ventricle, two-thirds projecting into ventricle, ruptured and daughter cyst escaping: another daughter cyst free under tricuspid valve. Lungs — both contained innumerable hydatid cysts from the size of a pea to a big nut. Many daughter cysts free in bronchi. Hydatid cyst of heart primary with secondary echinococcosis of lungs. No hydatid cysts elsewhere. This was doubtless a case of the "rupture iterative" of Dévé.

Quill in 1904 reported a case of hydatid cysts in heart and lung simulating pulmonary tuberculosis (obs. xii of

Fig. 5. Hydatid cyst of the right auricle of the heart. From Dévé and Bopp, "L'Echinococcose Pulmonaire Metastatique" Thèse de Paris, 1916. Specimen sent to the Pathological Institute of Tuebingen in 1875 by Dr. W. Palm of Ulm.

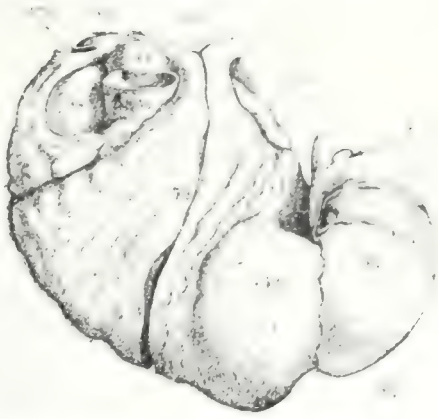

Fig. [illegible] Multiple hydatid cysts of the heart [illegible] cysts of left ventricle; 3 suppurating intrapericardial cyst projecting opposite the infundibulum of the pulmonary artery; 4 and 5 cysts developed at the level of the sinus of Valsalva [illegible] specimen from a young French soldier who died suddenly, sent by Dr. Jirow to [illegible] for examination. From [illegible] *cardiques par l'oreillette gauche.* Masson et Cie, 1920.

Dévé and Bopp). The case was that of a Scotch soldier age 23 with symptoms of tuberculosis — hæmoptysis, night sweats, evening temperature, wasting, etc., but not the physical signs of phthisis. Suddenly intense dyspnœa occurred followed by collapse, and he died in a few hours. Postmortem: heart — large antemortem clots in both ventricles. In right ventricle a large pedunculated hydatid cyst, with daughter cysts free in ventricles. The fatal dyspnœic attack caused by blocking of the pulmonary artery by daughter cysts. Again the "rupture iterative" of Dévé. Lungs: right — hydatid cyst size of small orange in center, and several other scattered ones. Left — a big superficial cyst, the size of an orange, at its summit, with three smaller scattered ones. No hydatids elsewhere.

Grulee in 1905 reported a case of echinococcosis of the heart (obs. xiii of Dévé and Bopp). His patient was an Italian woman age 27 who had been 1 year in America. She had symptoms of pulmonary tuberculosis, was pregnant, and had loud systolic pulmonary and apical murmurs. On April 5 she coughed up an hydatid cyst. On April 10 she died suddenly: postmortem cæsarian section. Postmortem: heart — hydatid cyst size of a pigeon's egg in posterior wall of right auricle which had ruptured into its cavity. The clot contained several daughter cysts. The walls of the heart cyst were drier and harder than those of the lung cyst. Lungs — both full of hydatid cysts size of pea to hen's egg. Right lung only tubercular. No hydatid cysts found elsewhere. Again, "rupture iterative" of Dévé.

Watson, of Australia, reported and figured a case in 1906.

Cristopherson, in the Sudan, reported a case of hydatid cyst of the left ventricle in a man, age 40, in 1909. Sudden death occurred a few days after an operation for elephantiasis of the scrotum, and the cyst was discovered postmortem. A primary rupture had passed unnoticed, for the cyst was full of daughter cysts. Incidentally this was probably one of those cases so aptly described by Dévé, in which the heart cyst had first ruptured outwards into the pericardium (only one such rupture is possible because of the adhesions produced) and subsequently intracardially.

Baecchi, in 1909, reported a case of hydatid cyst of the heart and compared it with 58 others which he had collected from literature.

In 1911 Lemanski, Durand, and Roques reported a case of hydatid cyst of the heart (obs. xiv Dévé and Bopp). Girl age 17 with symptoms of pulmonary tuberculosis. No heart murmurs. Dyspnœa and severe neuralgia in sixth interspace. Died suddenly. Postmortem: heart — right auricle showed a large papillomatous vegetation on its posterior wall, and a cavity contained an hydatid cyst the size of a pigeon's egg. Many daughter cysts. Lungs — right and left contained about 12 cysts each. No hydatid cysts elsewhere. Primary hydatid cyst of the heart with secondary metastatic pulmonary cysts.

In 1915 Foresti and Bonaba, of Uruguay, reported "a case of multiple visceral hydatid cysts (heart, brain, kidneys): rupture of an hydatid cyst into the left auricle" in a girl of 13. The left ventricle [illegible] daughter cysts and a cyst opened into the left auricle. The right auricle was [illegible] by a cyst the size of a nut, full of daughter cysts. The mother cyst [illegible] the left heart instead of the right as usual.

In 1916, the total number of reported cases had risen to 105 according to Dévé and Bopp who reported a hitherto unpublished case from the Pathological Institute of Tuebingen (obs. xv), sent to the institution by Dr. W. Palm, of Ulm, in 1875. Postmortem: pericardium [illegible] right auricle contained an hydatid cyst the size of a prune with several daughter cysts. Many hydatid cysts, from the size of a cherry down, in the adjacent parts of attached lung. Primary hydatid cyst of the heart with secondary pulmonary metastases. In 48 of these 105 cases intracardial rupture had occurred 28 times into the right heart.

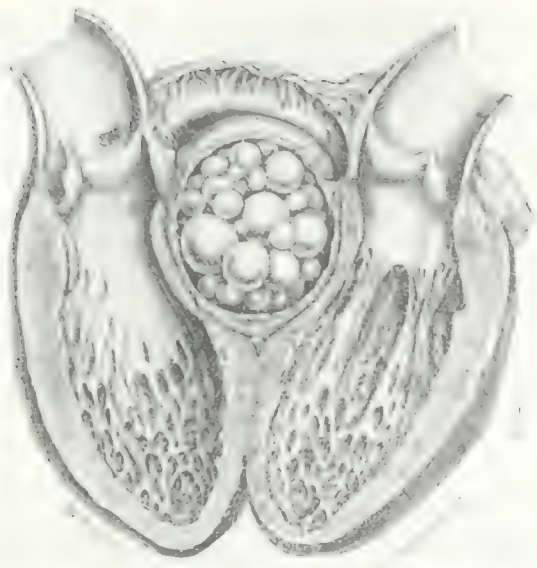

Fig. 3. Hydatid cyst in the loose tissue of the auriculo-ventricular septum of the heart. This plate illustrates the point, especially labored by Bland-Sutton, that the selective habitat of the parasite is the loose subserous tissue. From *Tumors, Innocent and Malignant*, by Sir John Bland-Sutton, 1922. Reproduced here by permission of the publishers, Messrs. Cassell & Co. Ltd.

In these latter the results were as follows: 5 times sudden death from anaphylaxis; in 11 cases death occurred in a few months from vesicular emboli of pulmonary artery; 12 times subsequent pulmonary metastases resulted.

In 1920, Arrizabalaga, of Uruguay, published a paper on venous hydatid metastases, pointing out that the original cyst is usually in the right heart, and the lung metastases usually multiple and small, seldom as large as an orange.

In 1921 Martin and Crespigny, of Australia, reported a case of hydatid cyst of the heart. Postmortem — hydatid cyst 5 centimeters in diameter of right auricle with many daughter cysts. Again an example of "rupture iterative" of Dévé.

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ABSCESS OF THE LUNG

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Surgeon to the Mayo Clinic

In spite of the fact that within recent years complete and authoritative articles on abscess of the lung have been published, I make no apology for again bringing this serious disease to the notice of the medical profession.

There are few conditions, which, arising often from such trivial and preventable causes as does abscess of the lung, so quickly and completely incapacitate a person, rendering him a burden to himself, his friends, and society. The progressive weakness, the distressing cough, the long convalescence, and above all, the foul smelling and tasting sputum, break the morale of the stoutest patient, and present one of the most difficult conditions to relieve.

Because localized gangrene and abscess are so closely associated, it is usually impossible to determine whether or not one has supervened on the other or preceded the other. For the purpose of discussion, we include under abscess of the lung all types and degrees of abscess except those due to tuberculosis and bronchiectasis and all degrees of gangrene of the lung except a massive gangrene involving an entire lobe or lung. During the war, I saw many of the latter due to anaerobic infection on a traumatic lesion but, apart from these, I have seen only five cases of massive gangrene in civil practice.

HISTORY

Hippocrates pointed out that lung abscess sometimes bursted into a bronchus and cured itself spontaneously; and that occasionally it ruptured into the pleural cavity and had to be drained. Willis, in 1664, and Purmann, in 1692, suggested incision for drainage, and Baglivi, in 1696, opened a lung abscess resulting from a saber thrust. Great impetus was given to the study and treatment of the condition in the eighteenth century. Du Barry, in 1725, reported three cases, one of the patients died following drainage, and two recovered. Campardon, in 1759, described a cure following drainage. Sharpe, in 1769, suggested early intercostal puncture. Pouteau and David, in 1783, advised radical exploration and opening of abscesses. Pouteau, in 1793, reported operative cures, and in the same year Gumprecht published an exhaustive treatise on the condition. Faye, in 1797, reported a cure following operation. Because

TABLE I.—ABSCESS OF THE LUNG

	Cases
Males	41
Females	18
Age Incidence	
From [illegible] to [illegible] years	3
From [illegible] to [illegible] years	3
From [illegible] to [illegible] years	13
From [illegible] to [illegible] years	18
From [illegible] to [illegible] years	[illegible]
From [illegible] to [illegible] years	3
From 61 to 70 years	4
Leucocytes	
From 5,000 to 47,000	
Average [illegible]	
Below 10,000	4
With leukopænia, 5,000	1
Average haemoglobin [illegible] per cent	
Cause	
Tonsillectomy (all general anæsthesia but one)	16
Extraction of teeth	3
Influenza	10
Pneumonia	2
Bronchopneumonia	1
Operation (harelip and cleft palate)	1
Operation (drainage of frontal sinus)	1
Inhalation (peanut, tack, and tooth)	3
Trauma	2
Hydatid cyst	1
Actinomycosis	1
Appendectomy	1
Polya operation	1
Focal infection (senile gangrene 1, vaccination 1, discharging sinus from scarlet fever 1)	3
Uncertain origin	7

TABLE II.—SYMPTOMS, COMPLICATIONS, SPUTUM, WEIGHT LOSS, WEIGHT GAINED

Symptoms	
Average duration (before coming to the Clinic)	18 weeks
Productive cough (foul and blood-stained sputum)	
Chills, fever, sweats	
Loss of appetite	
Loss of weight, progressive weakness	
Pain in chest	
Dyspnœa	
Clubbing of fingers	
Watch crystal nails	
Leucocytosis	
Low hæmoglobin percentage	
Recurrent type	
Complications	Cases
Empyema (one opposite chest)	4
Encapsulated empyema (same side)	2
Bronchiectasis (same or opposite side)	6
Senile gangrenous foot requiring operation	1
Subphrenic abscess (same side)	1
Hydatid cyst of the liver	1
Actinomycosis	1
Sputum, Scale 1 to 4	
1, 1 to 5 ounces each day	15
2, 6 to 10 ounces each day	18
3, 11 to 20 ounces each day	16
4	3
Amount indefinite	2
Foul (probably more)	25
Blood-stained at times	20
Elastic tissue (in one case only once in six examinations)	2
No tuberculosis bacilli	
Weight Loss	
From 5 to 53 pounds; average 37 pounds; more than 30 pounds	12
Weight Gained after Treatment	
From 11 to 80 pounds; often above normal; average pounds	32
Albumin in urine (probably more)	16
Clubbing of fingers (probably more)	14
Watch crystal nails (probably more)	11

of the indifferent results following surgery, and especially because of the influence of Trousseau, for the next one hundred years there was a return to more palliative methods of treatment.

Von Herff, Krimer, and Stokes, in the early part of the last century opened abscess cavities with a trocar. Bell, in 1805, reported one cured patient and several failures. Richeraud, in 1812, and Jaymes, in 1813, reported cures. Callisen, in 1815, advised digital exploration of the lung, accurately to outline the abscess and establish free drainage. Zang, in 1818, operated on eight patients. Breschet, in 1831, McLeod, in 1836, Claessens, in 1837, and Hastings, Herff and Collins, in 1844, reported cases. Nasse, between 1824 and 1844, advised surgery and operated on several patients successfully. Borchert pointed out that before undertaking drainage the exact site and limit of the lesion should be determined, and that no other foci should exist in the same or other lung. According to Garré, during the one hundred years, up to 1893, only twenty-two authentic cases are reported in the literature.

Green, in 1860, attempted to catheterize abscesses, and various injections directly into the bronchial tube were employed, but with unsatisfactory results. Maragliano, however, reported the cure of an abscess of 30 years' standing with injections of silver nitrate.

Koenig, in 1864, wrote at length on the subject, and a little later Jaszenko did some interesting experiments on penetrating intrathoracic and pulmonary wounds. In 1872,

TABLE III.—LOCALIZATION, TREATMENT

Localization [illegible]	
Right upper lobe	[illegible]
Right lower lobe	[illegible]
Middle lobe	[illegible]
Left upper lobe	5
Left lower lobe	[illegible]
Hilus ([illegible] left, 1 right)	[illegible]
Not clearly defined	[illegible]
Treatment	
Medical	[illegible]
Dead	[illegible]
Not greatly benefited	5
Fair health	[illegible]
In good condition	[illegible]
Surgical	[illegible]
Dead	[illegible]
Good health	[illegible]
Fair health (discharging sinus)	3
Total number treated [illegible], deaths [illegible] per cent	
Duration of treatment in Clinic	44 days
Obliged to quit occupation on an average	13.75 months
Average time on treatment at Clinic or until returning to work	[illegible] months
Patients obliged to change occupation entirely	7
Patients obliged to change climate entirely	[illegible]

TABLE IV.—[illegible]

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Without operation [illegible] suddenly at home, apparently without relation to [illegible]	3

Waring-Curran reported a spontaneous cure after the abscess had ruptured through the diaphragm, followed along the round ligament, and burst through the skin at the umbilicus.

Mosler and Hueter, in 1873, were the first deliberately to open a bronchiectatic cavity in the right upper lobe. They went through the third intercostal space, opened the cavity, introduced a tube through which pus was carried off, and irrigated the cavity with carbolic acid. Truc, in 1885, wrote a classical treatise on the subject, and Schmidt and Block the same year wrote on the surgical treatment.

Gluck, Schmidt, Block and Biondi, were the first to show that partial resection of the lungs was possible in animals. The work of Fenger, Bull, Reclus, Quincke, Tuffier, Karewski, and Garré followed.

Fenger, in 1881, reported 5 collected cases and 1 of his own; all the patients died following operation except his own. Bull, in 1882, reported 19 cases, of which 14 were probably true abscess. In 1884, he performed outstanding work for that period. Runeberg, in 1887, collected 11 cases, in which 2 patients had recovered following operation; in 3 cases the diagnosis was doubtful. Martius, in 1891, collected 22 cases in which abscess was found at necropsy only. Humber, in 1893, reported a successful operation for lung abscess on a child [illegible] months old.

Artificial pneumothorax was employed for the first time in 1894. Forlanini employed it in the treatment of a tuberculous cavity. In 1897, Tuffier, in his classical monograph on thoracic surgery, collected 216 thoracic cases in which operation had been performed. In [illegible] there was definite cavitation, in [illegible] abscesses, and in 11 abscesses due to foreign bodies imbedded in the lung.

Murphy, in an address on thoracic surgery in 1898, was almost 20 years beyond his time. He advocated the treatment of lung abscess that should, in my opinion, be adopted today. Eisendrath, in 1901, collected 25 cases of abscess of the lung following pneumonia, [illegible] of which were in children under [illegible] years. McRae, in 1902, thoroughly reviewed the literature on the subject and reported 75 collected cases of lung abscess following pneumonia found at necropsy. In 1903, Garré collected 278 cases. During the past 20 years important contributions to the subject have been made by Lenhartz, Koerte, Kuelbs, Andrews, Lord, MacKenzie, Scudder, Tewksbury, Picot, Whittemore, Perthes, Robinson, Richardson, Meyer, Beck, Lillienthal, Manges, Tilton, Lloyd, Wessler, Norris and Landis, Hedblom, Hartwell, Lemon, Lynah, and others.

From April, 1920, to November, 1921, 54 patients were treated for abscess of the lung at the Mayo Clinic (Tables I, II, III, IV, and V).

ETIOLOGY

Predisposing causes are: diabetes, alcoholism, fatigue, exposure, starvation, wasting diseases such as typhoid and typhus, and

TABLE V.—ABSCESSES OF THE LUNG FOUND ONLY AT NECROPSY

	Sex Age	Operation	Leucocyte count probably after abscess had developed	Cause	Duration of illness, days	Location of abscess	Remarks, necropsy findings, abscess
[illegible]	F [illegible]	Salpingectomy	[illegible]	Pelvic abscess from subdiaphragmatic abscess	45	Left lower lobe	Right hydrothorax; left intraperitoneal subdiaphragmatic abscess; thrombosis of portal vein; ascites
[illegible]	M [illegible]	Cholecystectomy; [illegible] appendectomy		Bilateral lobar pneumonia	10	Left lower lobe; multiple	Bilateral lobar pneumonia; death attributed to the diffuse pneumonia
[illegible]	M [illegible]	Resection of bladder [illegible] days later nephrectomy for pyonephrosis		Pyemia, [illegible]	13	Multiple; bilateral	Pyemia, uraemia given as the clinical cause of death
[illegible]	M [illegible]			Influenza	25	Multiple; bilateral; both lower lobes	Bilateral empyema; cerebrospinal syphilis
[illegible]	M 62		[illegible]	Septicaemia from an infected finger	28	Multiple; bilateral	Multiple abscesses of lung, spleen and lymph nodes of right axilla and right lobes; staphylococcus albus found in the blood
[illegible]	M [illegible]	Partial gastrectomy and [illegible] nectomy			8	Multiple in right lung	Peritonitis; chronic diffuse nephritis; abscesses were probably embolic
[illegible]	M [illegible]	Cholecystectomy and choledochostomy			10	Left lower lobe; multiple	Multiple lung abscesses
[illegible]	M [illegible]	Posterior gastro-enterostomy for cancer of pylorus		Bronchopneumonia	9	Right upper lobe	Bilateral coalescing bronchopneumonia
[illegible]	M [illegible]	Suprapubic prostatectomy		Bronchopneumonia, repeated multiple pulmonary emboli 8 days after operation	14	Multiple; both lungs	Acute and chronic cystitis with infection and necrosis of prostatectomy wound; thrombosis of prostatic plexus; propagating thrombus in the left, common iliac veins; multiple repeated pulmonary emboli with infarction; bronchopneumonia and multiple abscesses of both lungs
[illegible]	F [illegible]		54,000	Influenzal bronchopneumonia	23	Right upper lobe	Bilateral empyema; bilateral purulent bronchitis
[illegible]	F 54		[illegible]	Bronchopneumonia both sides	14	Multiple; bilateral	Right empyema; coalescing bronchopneumonia
[illegible]	M 59	Posterior gastro-enterostomy, gastric ulcer	19,800	Bronchopneumonia	22	Right side	Gangrenous bronchopneumonia with a central abscess (right lung)

such malignant infections as variola. More direct causes are: operations around the nose and throat, lobar pneumonia, bronchopneumonia, influenza, bronchitis, emboli from distant foci, inhalation of foreign bodies, vomitus, or irritating gases, emersion, direct extension from adjacent collections of pus, as in empyema, subphrenic abscess, liver abscess, appendiceal abscess, and mediastinal abscess, breaking down of mediastinal or hilus glands, penetrating wounds, direct trauma of the chest wall, necrosis, syphilitic and carcinomatous lesions, ecchinococcus and dermoid cysts, and infections with actinomyces bovis, amœbic lung fluke, bacillus mallei and fungi of the genus oidium and aspergillus.

Opinions have always differed regarding the relative incidence and etiology of the disease. I have been impressed by the high percentage of patients in whom the condition follows operations around the nose and throat, and particularly tonsillectomy. In these days when tonsillectomy is so lightly advised and frequently employed, it should be thoroughly emphasized that lung abscess is not a rare sequela, nor one to be lightly entertained.

Not long since I [illegible] mine, whose daughter was about to have a tonsillectomy under general anæsthesia, the danger of abscess following operation under such an anæsthetic, and urged the use of local anæsthesia. Ether was employed, the girl developed a lung abscess, and now (1 year later) she is slowly convalescing. Undoubtedly abscess occurs much oftener after tonsillectomy in which general anæsthesia is employed. In 25,000 tonsillectomies at the Mayo Clinic, one case only has occurred and that in association with general septicæmia. Richardson, in 1912, was the first to point out the occurrence of lung abscess following tonsillectomy under general anæsthesia. Bassin, in 1913, collected 16 cases following tonsillectomy. Manges reported 9 cases seen at Mt. Sinai Hospital in 1 year, and quotes Wessler that 28 per cent of the cases of pulmonary operations seen in the roentgen-ray department of Mt. Sinai Hospital were due to tonsillectomy. Pottenger, in 1919, reported having seen in one and one-half years, 20 cases following tonsillectomy. Of 32 lung abscesses reported by Whittemore, in 1921, 17 followed tonsillectomy.

Richardson believes that abscess is the result of an embolic process. Coakley, in discussing Richardson's article, says that abscess is due to the aspiration of infected blood or pieces of tonsillar tissue. "The thick, cheesy or thin milky, bacteria-laden secretion within the tonsils is expressed out either when the tonsils are seized by forceps, as in the dissection method, or as the tonsils are pushed through the fenestra of the tonsillotomy, as by the Sluder method." This seems logical. Emboli from the plexus of veins in the tonsillar bed undoubtedly cause a small percentage of such cases; but the majority of them follow aspiration. Of 208 reported abscesses of the lung following tonsillectomy, 7 only were in patients operated on under local anæsthesia. The following facts favor the theory that it is usually by aspiration that infective material is carried to the lung:

1. An extremely small percentage of abscesses of the lung have followed tonsillectomies and other operations on the mouth [illegible] employed.

2. A higher percentage of abscess occurs in the insane, alcoholics, and drug addicts, than in a corresponding number of normal persons. This is undoubtedly because swallowing is not always the well controlled act by these persons that it is in normal persons. Under general anæsthesia, the influence of alcohol or drugs, the pharyngeal reflex is slowed or absent, so that mucus, vomitus, particles of food, [illegible], and so forth, readily enter the trachea.

Reports and opinions vary with regard to the incidence of lung abscess following lobar pneumonia. Early writers considered abscess of the lung a frequent sequela of lobar pneumonia. Laennec says that such abscess follows pneumonia so commonly that in the [illegible] hand, Fraenkel, in observing 1200 patients with lobar pneumonia, found less than 2 per cent with evidence of abscess. McRae collected 75 cases following acute lobar pneumonia. Hamman says that Aufrecht found none in 1501 patients with lobar pneumonia. Aufrecht, in 253 fatal cases of pneumonia, found only three abscesses at post-mortem. Hartwell states that of 770 patients with pneumococcus lobar pneumonia at the Rockefeller Hospital, only 2 developed abscess. He quotes MacCallum: "I am skeptical about those abscesses said to occur in the course of a pneumococcus lobar pneumonia." In all I have collected only 127 cases reported as due to lobar pneumonia. I agree with Whittemore who says: "Although medical books give lobar pneumonia as the most common cause of lung abscess, in my experience it has seldom, if ever, been the cause." In our last series, two cases only were due to lobar pneumonia.

Bronchopneumonia is followed by abscess in a small percentage of patients. I have collected 32 such cases. However, I agree with Hamman that lung abscess is more common following bronchopneumonia than following lobar pneumonia. One hundred and fifteen other cases are reported in the literature as following pneumonia, but it is not clearly stated whether they were lobar or bronchopneumonia. There is no doubt that particular-

TABLE VI.—CAUSE OF ABSCESS OF THE LUNG IN REPORTED CASES

Author and date	Preceding pathological condition	Aspiration of	Embolism from
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]		
[illegible]		[illegible]	
Pneumonia, type not given			Abscess of the liver 1; abscess of the appendix 1
		Foreign body 5	
		Foreign material during tonsillectomy 19	
	Croupous or lobar pneumonia 8; pneumonia, type not given 1		
[illegible]	Croupous or lobar pneumonia 9; bronchopneumonia [illegible] monia 8; pneumonia, type not given 1	[illegible]	Typhoid fever 1; suppuration in abdomen 1; abscess of kidney 1; abscess of lip 1; abscess of pharynx 1; abscess of seminal vesicle 1; abscess of skin 1; suppurative otitis media 2; vegetative carditis 4; thrombosis of lateral sinus and internal jugular vein, mastoid disease 1
[illegible]	[illegible]	Foreign material during tonsillectomy, [illegible]	
[illegible]	[illegible]		
[illegible]		Portion of tooth 9; portion of cancer of jaw 1; portion of cancer of lip 1; portion of cancer of tongue 1; pus from abscess of tonsils 1; foreign material during tonsillec[illegible]	
[illegible]		Foreign material during tonsillectomy 3	
[illegible]		Foreign material during tonsillectomy 3	
[illegible]		Foreign material during tonsillectomy 9	
[illegible]		[illegible]	
[illegible]		Snail shell 1; foreign material during operation on nasal septum 1	
[illegible]		Foreign material during tonsillectomy 4	
[illegible]	Pneumonia, type not given 37; empyema 3; mild in[illegible]	Foreign material during tonsillectomy 21; material during coma from drugs and [illegible] 1; sea water 1; foreign material during operation on nose 1; portion of [illegible] 1; foreign material during [illegible] 1; traumatized tissue 1	
Schwartz and Wessler	[illegible]	Foreign material during tonsillectomy 6	
[illegible]	Croupous or lobar pneumonia, type not given 12; influenza 1; empyema 2	[illegible] tonsillectomy 5; foreign body 2; traumatized tissue 1	Cancer of stomach 51, gastric ulcer 2, duodenal ulcer 1; abscess of appendix 1; abscess of liver 1; subdiaphragmatic abscess 1
[illegible]		[illegible]	
[illegible]		Foreign material during tonsillectomy 6 or 8	
[illegible]		Foreign material during tonsillectomy 1	
Simpson and Noah, [illegible]		Foreign material during tonsillectomy 2	
[illegible]	[illegible]		
Rendleman, 1920		Foreign material during tonsillectomy 1	
M. Kinney	[illegible]	[illegible] tonsillectomy 2	Suppurative otitis media 5; thrombosis of pulmonary vessels 4

TABLE VI.—CAUSE OF ABSCESS OF THE LUNG IN REPORTED CASES—CONTINUED.

Author, date	Preceding pathological condition		
Hartwell, 1920	Croupous or lobar pneumonia 22; purulent bron-		
Fisher, 1921			
Porter, 1921			
Williams and Dodd, 1921			
Meis, 1921	Croupous or lobar pneumonia 7		
Lynah, 1921	Croupous or lobar pneumonia		Infected
Whittemore, 1921	Actinomycosis		
Lockwood, 1921	Croupous or lobar pneumonia 2, bronchopneumonia 1, actinomycosis 1, echinococcus cyst 1		

ly in lobar pneumonia, a certain percentage of patients develop small petechial abscesses which clear up without going on to extensive cavitation; these cases are neither diagnosed nor thought of as lung abscess proper.

During the severe epidemic of influenza, a small percentage of patients developed true lung abscesses. Practically in every patient who died, necropsy revealed small subpleural abscesses, but only a small percentage of those who survived, developed necrosis and cavitation to a degree that the lesion could be diagnosed as lung abscess. In 10 cases of our series, influenza was given as the cause. Of 100 patients with prolonged influenzal pneumonia, quoted by Hedblom, abscess occurred in 3.

Empyema with rupture through the visceral pleura and extension into the parenchyma of the lung with the development of a true lung abscess does occur, but is extremely rare. The process is usually reversed.

A fair percentage of all the lung abscesses reported have been the result of aspiration of foreign bodies, or of infected blood and mucus from operations around the nose and throat, or during the extraction of teeth, or of pathological products of suppurative lesions around the nose, buccal cavity, and throat, from diphtheria, cancer of the lip, tongue, jaw, or larynx, diverticulitis of the œsophagus with regurgitation and difficult swallowing, cancer of the œsophagus or mediastinum perforating the trachea, and during examination with the bronchoscope or œsophagoscope, and the passing of an œsophageal bougie or stomach tube. Sixty-eight cases are reported due to inhalation of foreign bodies. Weist collected over 1000 reported cases due to aspiration of foreign bodies into the bronchi; a kernel of corn was the chief offender. Eight cases are reported following aspiration of sea water; Bullowa saw four such patients in 1 year. Five cases are reported following trauma. I have seen 4 such cases aside from those following gunshot wounds.

A definite percentage are due to embolism. Emboli may be carried to the lung in pyæmia, from suppurative middle ear diseases, puerperal sepsis, ulcerative endocarditis, gangrene, venous thrombosis, distant abscesses, and so forth.

Hartwell reported 4 cases of pulmonary thrombosis following general operations. Hedblom reported 19 abscesses found at necropsy following operations. It is possible that a small percentage of these may have been due to pulmonary thrombosis. On the whole,

however, I believe abscess is a rare sequela of such a condition. I have never seen such a case. Table VI

MORBID ANATOMY AND PATHOLOGY

Abscesses of the lung may be large or small, single or multiple, acute or chronic, simple acute or acute gangrenous, or simple chronic or chronic putrid. An abscess that persists longer than 2 months is considered chronic. The pathology of abscess of the lung is as varied as its etiological factors.

Abscess of the lung differs from abscess elsewhere. In the lung a variable area, even a whole lobe, may be the seat of some other disease, the abscess developing within the diseased portion, whereas the tissues surrounding abscesses in other organs are usually normal. Abscess may develop in previously healthy lungs, but more often occurs in tissue already inflamed or at least in tissue offering a lowered resistance to such a process. For example, while aspiration abscess develops in healthy lung tissue, it probably more easily gains a foothold in the lung of a patient already debilitated or in a lung that has recently been the seat of a pneumonic process.

Traube, in 1823, classified pulmonary gangrene according to its origin in the blood vessels from embolism or thrombosis, in the bronchi or in the parenchyma of the lung. Abscess of the lung starts from these three sites. Generally speaking, there is localized or diffuse hyperæmia of a portion of the lung followed by diminished circulation to the part, ingress of pyogenic organisms, and necrosis and pus formation. In a pneumonic pulmonary abscess, the process is one of more acute inflammatory reaction, with exudation of leucocytes at certain points or in a single area not confined to the alveoli, but affecting the interalveolar tissue with a central area of necrosis, liquefaction, and cavitation. In the embolic and aspiration types, there is obstruction of the blood supply or of a bronchus, with localized ulceration, pyogenic infection, and necrosis.

A distinction between gangrene and abscess may be uncertain even at necropsy. Macroscopically, pulmonary abscess presents circumscribed, greyish yellow, greenish grey, or reddish brown areas containing pus, caseous débris, and often small isolated portions of pulmonary tissue and calcareous particles, so-called lung sequestra. The simple acute abscesses have necrotic walls and show almost no line of demarcation from the healthy lung tissue. This necrotic area is surrounded by a densely infiltrated inflammatory zone, and by an outer zone of œdematous lung tissue. The acute gangrenous cavities are more irregular, with reddish black, or greenish brown sloughing necrotic areas; they are extremely foul smelling and ill defined. They tend to infiltrate in the surrounding lung tissue, which is firm and airless and often the seat of small bronchiectatic cavities. The chronic abscesses are irregularly sacculated with a necrotic interior, but are usually walled off by a fibrous connective-tissue lining, and are nearly always surrounded by a limited area of bronchiectasis. The cavity ruptures usually into a bronchus, but occasionally into the pleural cavity, and in a small percentage it remains encapsulated with no outlet. I believe it is particularly from the latter type of abscess that bacteria reach the blood stream through the pulmonary veins and produce general septicæmia and pyæmia.

Pleural adhesions are present in the majority of the chronic cases, and probably in the majority of acute cases in which the abscess is situated peripherally. A fibrinous or seropurulent pleuritis and thickening of the visceral pleura covers the abscess area in most instances.

The bronchial glands are usually enlarged and the bronchial mucous membranes thickened and reddened by irritation. Often the mediastinal glands are enlarged. The bronchioles opening into the abscess in chronic cases are hard, sclerosed, and the seat of calcareous deposit, as are the adjacent vessels.

The majority of perforating abscesses from empyema rupturing through the visceral pleura into the lung, or through the diaphragm into the lung, usually show necrosis of a peripheral portion of lung tissue, without true cavitation. Occasionally well encapsulated abscess occurs not connected with the

empyema. It is probable that, primarily, a subpleural abscess, ruptured into the pleural cavity, caused empyema, and then healed on the visceral surface but extended into the tissue of the lung and developed into a true abscess.

Of 43 patients that I operated on late for the removal of pieces of shrapnel or bullets imbedded in the lung, 30 had a localized collection of pus around the missile but completely walled off from the healthy parenchyma by a definite fibrous sac. In only one case was there a patent bronchus opening into the cavity through which the patient raised some sputum.

If an abscess of the lung has developed around a foreign body imbedded in a bronchus, the abscess will be fairly well localized but extremely foul. Such a degree of necrosis indicates that the abscess supervenes on localized gangrene; a localized bronchiectasis usually surrounds such an abscess and extends along the involved bronchus.

The contents of pulmonary abscesses vary with the cause: pus, isolated shreds of lung tissue, hæmosiderin, cholesterol, pieces of metal, teeth, peanuts, kernels of corn, food particles, jelloid bodies typical of echinococcus, pieces of hair and so forth from a dermoid, and calcareous deposits may be found. In one case I found a calcareous sequestrum irregular and jagged, measuring about 3 by 1.5 centimeters. Fraenkel reported a deposit about 4 by 6 centimeters, in a large cavity in the right upper lobe.

BACTERIOLOGY

The bacteriological findings in abscess of the lung vary widely. While pyogenic organisms cause most of the abscesses, saprophytes are sometimes the cause. Anaerobic organisms are found in a fair percentage of cases, but practically always associated with pyogenic types. Even in abscess following lobar pneumonia, the pneumococcus or pneumonia bacillus of Friedlaender is almost always associated with other pyogenic strains. The bacillus of influenza, staphylococcus pyogenes aureus or staphylococcus pyogenes albus are present in many abscesses, very often streptococcus viridans, occasionally streptococcus hæmolyticus, and sometimes bacillus coli.

Cohn reports a case due to Friedlaender's bacillus only. Koranyi obtained a pure culture of staphylococcus pyogenes aureus from the blood of one patient, but could not demonstrate pathogenic bacteria in the sputum. Hartwell, in 148 patients with lung abscess and gangrene, found staphylococcus pyogenes aureus in most cases. Hitzig made eight bacteriological examinations of the sputum of a patient with abscess in the right lower lobe, and found the typical bacillus of influenza in every instance, but no other organism. The sulphur bodies of actinomycetes, filamentous organisms, yeast fungi, and spirochætæ should be looked for. Buday has found the fusiform bacilli and spirilla in most of the so-called gangrenous abscesses.

THE LOCATION OF ABSCESSES

The majority of abscesses develop in the peripheral portion of the lungs. In 71 of my cases, 57 (79 per cent) were peripheral; a small percentage occur in the hilus, and the rest centrally in the lobe.

Norris and Landis assert that they occur nearly three times as often in the right lung as in the left, and Lemon says that they occur three times as often in the lower lobes as in the upper. In Lemon's series they occur only twice as often in the right lobes. In 292 cases collected by Lemon, 86 were in the upper lobe, 192 in the lower, and 14 in the middle (Walker, Wessler, Norris and Landis, Lemon). I found in 537 collected cases, 381 (71 per cent) on the right side, and 156 (29 per cent) on the left side; 157 occurred in upper lobes, and 266 in lower lobes. That is, the right side was involved two and one-half times as often as the left, the lower lobes one and two thirds times as often as the upper, the right upper lobe three times as often as the left, and the right lower, one and one third times as often as the left lower, the middle lobe three fifths as often as the upper lobe and about three-eighths as often as the lower lobe. Multiple abscesses occur in approximately one-fourth of the cases, but are confined to the same portion of the lung in all but about one thirtieth of the cases.

TABLE VII.—LOCATION OF ABSCESS

Middle lobe	24 of 193	12.0
Lower lobe	67 of 193	35.0

Abscesses due to pneumonia and influenza are practically always peripheral and usually involve the visceral pleura. They occur about twice as often in the right lower lobe as in the left. According to Tuffier, 80 per cent of pneumonic abscesses are in the lower lobes. They are often multiple but are usually confined to one lobe. In 160 patients with lung abscess following pneumonia, the abscess occurred in the upper lobe in 46, and in the lower lobe in 102; two and one-fourth times as often in the lower lobe as in the upper. The right lower lobe was affected one and seven-ninths times as often as the left lower. On the whole, the right side was involved three and two-fifths times as often as the left.

Aspiration abscesses including those following tonsillectomy occur about three times as often on the right side as on the left and about two and one-half times as often in the upper lobe as in the lower. Abscesses following the aspiration of foreign bodies, such as tacks, teeth, and so forth, occur more often in the right lower lobe. The majority of those due to trauma occur in the right lower lobe (Tables VII and VIII).

SYMPTOMS

Abscess of the lung is a disease of symptoms rather than physical signs. The symptoms vary with the cause of the disease, the general resistance of the patient, the duration of the affection, and the extent of pulmonary involvement. When the abscess is due to pneumonia, prolonged fevers, septic emboli, or the more acute infectious fevers, the evidence of the development in the lung may be masked by the general constitutional signs of the disease. However, when cough, dyspnœa, pain in the chest, and the raising of foul sputum are added to the disease or are prolonged after the period that the ordinary affection of the lung or respiratory tract usually persists, abscess should be suspected. When abscess develops in cases of lobar pneumonia, although the temperature may fall as usual, it gradually mounts again usually higher than during the course of the disease, and is characterized by morning remission and evening exacerbations. The area of consolidation fails to undergo resolution, dullness persists, and bronchial breathing and diminished breath sounds will be detected on auscultation. As the process of necrosis and liquefaction continues, the sputum becomes thicker and more putrid, there may be signs of cavitation, a tympany on percussion, whispering pectoriloquy, amphoric or cavernous breathing, and coarse crepitant râles. Occasionally the pneumonia runs its regular course and the patient appears to all intents and purposes to be recovering entirely except that a small localized area of dullness still persists. About the fifteenth or twentieth day, patients begin to run an irregular fever, develop vague joint pains, occasional headache, and pain in the chest. A cough develops, then dyspnœa and suddenly, in a severe coughing attack, pus gushes from the mouth. Often (I believe in about 50 per cent of such cases) bright blood, varying from the faintest trace to a pint appears. I cannot find a case reported of fatal initial hæmorrhage in pyogenic lung abscess. The patient may recover rapidly after this, or he may recover partially, only to have similar repeated attacks, or run the course of an ordinary lung abscess.

Lung abscesses following tonsillectomy usually produce foul expectoration by the tenth or fifteenth day. Wessler states that sputum in an aspiration abscess becomes putrid on the fourteenth day. The great majority of these patients, if carefully observed, will show signs of a localized bronchopneumonia before the third day. A small percentage does not produce sputum before the third week, and in some cases not until the fifth or sixth week; they present the

TABLE VIII—LOCATION OF ABSCESSES DEFINITELY STATED

Author, year											
Waring Curran, 1872	1						1				
Fenger and Hollister, 1881	2					1					
Westbrook, 1886	1	1									
Aufrecht, 1902	27										
Clarke and Marine, 1906	21						14	7			
Koerte, 1908	7	1									
Barrington, 1913	6	1									
Norris and Landis, 1913	9	7		1	1		3				
Walker, 1914	142						71				
Scudder, 1914	16	8									
Manges, 1916	8	1	1		1		1	1			
Yankauer, 1917	1						1				
Tewksbury, 1918	19						7				
Hedblom, 1919	48	1									1
Wessler, 1919	99		1						1		
Schwartz and Wessler, 1919	19								1	1	1 lower lobes
Lemon, 1920	68		8						1		
Hartwell, 1920	50		3								
Whittemore, 1921	41								1	1	
Lockwood	42	8	2	11	5	1	1	1			
Total		31	14	7	13	40	31	94	4	1	1

same signs as the delayed pneumonia type and eventually rupture into a bronchus and run the same course as the group described following pneumonia. These abscesses are probably due to emboli from the tonsillar bed; necrosis and liquefaction occur and eventually the pus bursts through a bronchus and is spat up.

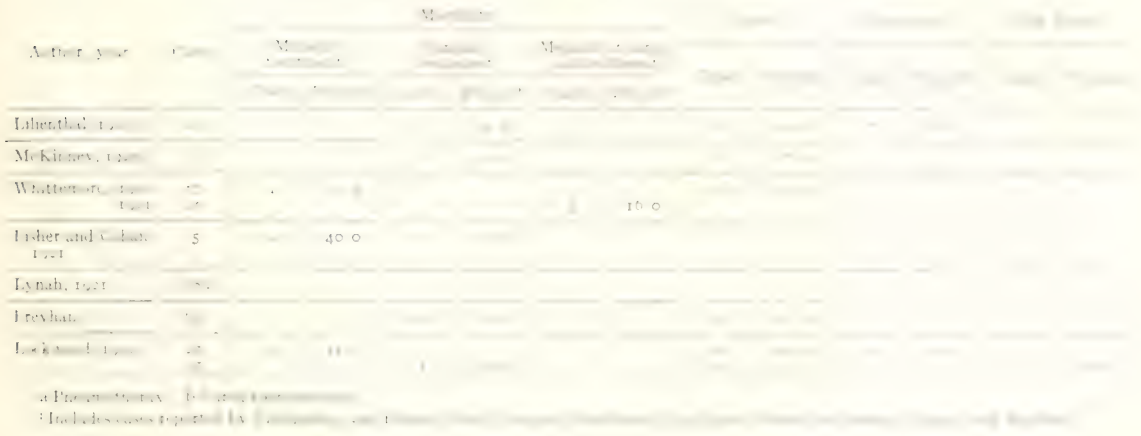
Regardless of the cause, loss of appetite, progressive loss of weight, emaciation, general weakness, pallor, productive cough, foul sputum, pain in the chest, variable dyspnœa, fluctuating temperature, and leucocytosis characterize the disease. In the closed type of abscess there is usually a peculiar putrid odor to the breath even though there is no sputum. Clubbing of the fingers occurs in most cases and watch crystal nails in a certain percentage. The peculiar clubbing of the fingers, characteristic of pulmonary hypertrophic osteopathy is interesting; Phemister and Butler have been particularly interested in it. The hæmoglobin is reduced in all chronic cases. In most cases the red count is low. Chills and sweating occur in most patients at some stage. Approximately 50 per cent of all patients have some blood in the sputum at some time during the course of the disease. Although Osler found elastic tissue in the sputum of every patient, and although Aufrecht says "The presence of abscess of the lungs can be positively assumed only when elastic fibers can be demonstrated in the sputum," a study of the literature and personal experience has led me not to expect it in more than one-third of the cases. In the

TABLE IX—ULTIMATE RESULTS

[illegible]	Cases	Mortality						Cured		Improved		With fistula	
		[illegible]		[illegible]		[illegible]		[illegible]					
		[illegible]	Percent	[illegible]	Percent	[illegible]	Percent	[illegible]	Percent	Cases	Percent	Cases	Percent
[illegible]	[illegible]							1	[illegible]				
[illegible]	[illegible]			[illegible]	[illegible]			[illegible]	[illegible]	1	4.0	1	4.0
[illegible]	[illegible]					20		[illegible]					
[illegible]	[illegible]			6	[illegible]			17	74.0				
[illegible]	[illegible]			[illegible]	28.0			40 [illegible]	61.0 61.0			5 [illegible]	7.0 8.0
[illegible]	[illegible]			[illegible] 7	[illegible]			9	41.0	[illegible] [illegible]	[illegible] [illegible]	1	[illegible]
[illegible]	[illegible] [illegible] [illegible] [illegible]			6 [illegible] [illegible]	[illegible] [illegible] [illegible]			24 [illegible] [illegible] 13	[illegible] 71.4 42.8 [illegible]	1 [illegible] [illegible] [illegible]	4.0 [illegible] [illegible] [illegible]		
[illegible]	[illegible]			[illegible]	[illegible]			51	68.0	[illegible]	[illegible]		
[illegible] [illegible]	[illegible] [illegible]			[illegible]	25.0	[illegible]	27.0	8	[illegible]				
[illegible]	[illegible]					[illegible]	[illegible]						
[illegible]	23					[illegible]	[illegible]	11	48.0				
[illegible]	[illegible]			[illegible]	[illegible]			71	[illegible]				
[illegible]	[illegible]			[illegible]	50.0			10	50.0				
[illegible]	54			[illegible]	37.0			20	[illegible]				
[illegible]	37 [illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible] [illegible]	68.0 [illegible]				
[illegible]	[illegible] [illegible] [illegible]	123	93.0	[illegible]	[illegible]								
[illegible]	[illegible]			[illegible]	[illegible]								
[illegible]	[illegible]			4	[illegible]								
[illegible]	[illegible]					[illegible]	[illegible]	5	[illegible]				
[illegible]	[illegible] [illegible]	[illegible]	[illegible]	7	29.0			14 [illegible]	58.0 29.0	3 4	[illegible] 24.0		
[illegible]			[illegible]		[illegible]								
[illegible]	[illegible] [illegible]			5	[illegible]	[illegible]	[illegible]						
[illegible]	[illegible]	[illegible]	[illegible]					[illegible]	[illegible]	[illegible]	[illegible]		
[illegible]	[illegible]					[illegible]	[illegible]						
[illegible]	[illegible]					[illegible]	[illegible]						
[illegible]	[illegible]			[illegible]	[illegible]			[illegible]	[illegible]				
[illegible]	[illegible]	[illegible]	[illegible]					3	[illegible]	1	20.0		
[illegible]	[illegible]	[illegible]	[illegible]					[illegible]	[illegible]	2	20.0		
Goldberg and [illegible]	[illegible]	[illegible]	[illegible]					12	75.0	[illegible]	[illegible]		
[illegible]	[illegible]	6		[illegible]	65.0			[illegible]	[illegible]				
[illegible]	[illegible] [illegible]			[illegible]	[illegible]								

[illegible] "Chronic putrid abscess. §Result unknown in remainder. §§ Several [illegible]

TABLE IX.—ULTIMATE RESULTS



present series it occurred only twice in 54 cases, even though the sputum was repeatedly examined. It should be borne in mind that necrotic processes in the larynx, trachea, bronchi, and pleuræ, may also produce elastic tissue in the sputum. The sputum on standing separates into three layers, the lower layer pus, the middle layer water, and the top layer foamy frothy mucus in which mucopurulent masses are suspended. Soft dough-like masses, usually excessively foul, the so-called Dittrich's plugs are often present, holding in suspension bacteria, particles of fat, fatty acid crystals, and epithelial débris. Particles of lung tissue and hæmosiderin may be present. Albuminuria, 1 on a scale of 1 to 4, usually develops in approximately one-half of the patients. Occasionally casts and epithelial débris are found. Diarrhœa is more a complication than a symptom and when present must not be considered lightly.

In certain cases, about one-fourth in my experience, the disease runs a peculiar recurrent course. Drainage does not occur freely from a bronchus or bronchi. The patients usually have an irregular course at the onset. Following the "bursting" of the abscess, the cavity is apparently emptied and patients begin to improve at once. Their sputum is less each day, their appetites improve, their aches and pains disappear, and they feel as though they are about to recover entirely. After a variable period, a few days or weeks, they begin to complain of increasing pain in the chest, an evening rise of temperature, perhaps headache and vague joint pains, and their appetites fall off. Chills and sweats may occur; often there develops a sense of fullness in the chest around the area involved, cough and dyspnœa increase, and again the abscess bursts. This type of abscess may run such a recurrent course for many months. Occasionally a small encapsulated empyema produces the same syndrome.

A thorough physical examination and a liberal interpretation of the findings are necessary. Signs of cavitation were elicited in less than one-third of our cases. Dullness on percussion and diminished breath sounds over the involved lung is the most constant sign. Large cavities may not be located on examination. On the other hand, a small superficial abscess that happens to be empty at the time may give the classical signs of a cavity. It is important to determine, by auscultation and percussion, whether the abscess is anterior, posterior, or lateral. It must be borne in mind that dullness on percussion, diminished breath sounds, and tactile fremitus may be due to the thickened pleura over the abscess or to empyema, encapsulated or free, as often as to consolidation of the lung. Important signs are, diminished excursions of the chest wall over the involved area, and retraction in the interspaces, usually present when adhesions are well formed and indicating a superficial abscess or a [illegible]

matory process. According to Norris and Landis, of 63 patients with abscess of the lung, definite physical signs were present in 8 only; in two-thirds the signs of cavity were entirely lacking or were not characteristic.

DIAGNOSIS

Diagnosis depends on the history, the roentgen-ray findings, examination of the sputum, and the general physical examination. An accurate history is essential, and on this alone the majority of lung abscesses may be diagnosed. The affection is three times as common in males as females. It may occur at any age, but occurs usually in early adult life, from 25 to 40 years. Thus it would seem that predisposing causes, such as exposure, excessive use of tobacco, alcohol, fatigue, and so forth, may play an important part. The location and extent of the lesion require a careful physical examination, but more especially, a thorough roentgenologic examination. Fluoroscopic examination and stereoscopic plates are essential.

The fluoroscope serves to rule out the presence of free or encapsulated fluid in the pleural cavity, the position and degree of movement of the diaphragm, the position of the heart and mediastinum, and affections of the aorta and mediastinum. Stereoscopic plates determine the location of the abscess, its extent, cavitation, the surrounding fibrosis or calcification, its position relative to the chest wall, whether single or multiple, and the presence of active or latent tuberculosis, carcinoma, syphilis, cysts, bronchiectasis, encapsulated empyema, massive gangrene, and foreign bodies. An empty cavity appears as a lighter shadow surrounded by a relatively dense shadow varying with the degree of inflammatory reaction, fibrosis, or calcification. The shadow is greater than the extent of actual necrosis. A fluid level in the abscess shows a horizontal line and the level shifts with the position of the patient. An air bubble may be present. Tuberculosis, bronchiectasis, and bronchopneumonia may be easily confused with abscess (Figs. 1 and 2).

In tuberculosis there is generally a characteristic mottling elsewhere in the lung, and especially at the apices, whereas pyogenic abscess rarely involves the apices and more commonly involves the lower lobes, particularly the right lower.

Apart from the history, bronchopneumonia may be determined by a shadow of more uniform density and no cavitation.

Bronchiectasis is a diffuse process and the bronchial shadows are more extensive and radiate from the hilus. Moore has pointed out the necessity of having the patient empty the chest before raying, particularly in the cylindrical and sacculated types.

Gangrene casts a denser shadow, usually more extensive, with irregular areas of varying density producing a coarse mottling effect.

In malignancy roentgenograms vary depending on whether the lesion is primary in the hilus, is lobar or miliary in type, or is a metastatic nodular or miliary type. Carman, in exhaustive articles on pulmonary malignancy, has pointed out that the diagnosis of pulmonary malignancy is nearly always possible from the plates, but that in certain cases, the patient's history and physical examination must be considered. In primary cancer the shadow is of more uniform density, is more sharply outlined and is regular. While there may be a hazy area of infiltration around the growth, it is different from that due to inflammatory reaction. Smaller shadows of local metastasis are usually present. Metastatic malignancy of the nodular type might occasionally be mistaken for multiple abscesses. The shadows are denser, more widely scattered; the extension is peripheral, and usually involves both lungs. The apices are rarely involved.

Sarcoma presents a uniformly dense shadow, more regular and sharply defined than abscess.

Echinococcus cysts or dermoids present sharp, circular, well-defined areas of increased density, usually in the right lower lobe. Pneumoconiosis (anthracosis, cholicosis) presents a different picture. There are scattered fine mottlings, distributed symmetrically throughout both lungs suggesting miliary tuberculosis, but not borne out by the history. They may be in upper lobes particu-

larly but the apices are not usually involved It may be difficult to differentiate from fibroid phthisis.

DIFFERENTIAL DIAGNOSIS

The following must be ruled out: Lung abscess due to tuberculosis, diffuse gangrene, bronchiectasis, empyema with a bronchial fistula, encapsulated empyema, interlobar empyema, unresolved pneumonia, purulent bronchitis, diffuse peribronchial lymphangitis, abscess of the mediastinum, syphilis, cancer of the lung or mediastinum, ecchinococcus or dermoid cysts either in the lung, mediastinum, pericardium, or diaphragm, and aneurism of the aorta. The sputum should be repeatedly examined for the bacilli of tuberculosis. Apart from the history, one must rely mainly on the roentgen-ray to differentiate these conditions.

Needling of a pulmonary abscess as a diagnostic method is mentioned only to be condemned. Lord points out: "Exploratory puncture is an unjustifiable method that cannot be too strongly condemned." Murphy, Lillienthal, and Eisendrath agree. Sudden death due to pleural syncope or to cerebral emboli may occur. Empyema results in a certain percentage. Troublesome superficial abscess may develop. A blood vessel may be injured and bleed freely.

It has been suggested that the bronchoscope should be used as an aid to diagnosis. Personally I can see no reason for submitting a patient to such examination unless there is a possibility of the patient having aspirated something. I would advise against its use in extensive abscess where flooding of the same bronchial tree or the opposite with foul pus may result. In any case, it is extremely rare that a definite cavity can be visualized through a bronchoscope. A bronchus leading from the cavity and discharging pus is usually all that can be seen.

COMPLICATIONS

The complications of pulmonary abscess vary, particularly with the etiology, and may be more serious than the disease itself. With practically all superficial abscesses there is an adhesive pleuritis with a matting together of the parietal and visceral pleuræ. Occasionally a serous pleuritis develops which may later become purulent empyema. The [illegible] of pleuritic adhesions varies: Picot, in 149 pneumotomies, found them in 53 per cent, Tuffier in 57 per cent. In [illegible] cases from the Massachusetts General Hospital (Lord) were the lungs free. McRae, in 75 collected cases, reports adhesions present in [illegible] per cent of acute cases and in [illegible] per cent of all cases.

Occasionally localized bronchiectasis surrounds the abscess, and may extend to the hilus. Conditions as follows may develop: arthritis, endocarditis, pericarditis, subphrenic abscess, mediastinitis, brain abscess, septicæmia, pyæmia, amyloid disease, diarrhœa, gangrene, and hæmorrhage. Hæmorrhage is a dangerous complication. Lord had one death in 50 patients. Patschke, Kraus, Garré, Tuffier, Westbrook and Lockwood each had a death from hæmorrhage (a small pulmonary arterial aneurism or artery rupturing in the cavity). Repeated severe hæmorrhage greatly reducing the patient's resistance and ability to combat the disease is a serious complication

Cerebral abscess is a grave complication. Martius, in 1891, collected 22 cases at necropsy. Cameron, in 1907, found 17 cases. Hedblom found 2, and Fabricant 1. Hamman believes that brain abscess is a common sequela. We have recently observed 3 patients with brain abscess, 1 recovered and 2 died. These cerebral lesions are due to detachment of infected emboli from thrombi in the pulmonary veins; they are more often multiple than single and produce a syndrome of Jacksonian epilepsy. They may produce hemiplegia or monoplegia, loss of vision, persistent headache, psychosis, and ultimate death. The left side of the brain is most often affected.

Diarrhœa is a complication or perhaps more properly a late symptom of a systemic involvement and calls for urgent investigation. Proctoscopic examination should be made and every means taken to determine the cause. If diarrhœa persists and the patient is not holding his own, the abscess should be operated on. Unfortunately, it is very often

. . . evidence of pyæmia, and even though the abscess may clear up, the patient dies of the diarrhœa and general weakness. Necropsy may reveal minute ulcerations in the intestine but often only an inflammatory and irritative congestion.

PROGNOSIS

The prognosis depends on the cause, the extent of the lesion, the general resistance of the patient, and the treatment. The extreme toxicity of emulsified tissue in pulmonary abscesses and even of normal lung tissue has been shown experimentally (129, 194). The prognosis is more favorable in abscesses following lobar pneumonia and trauma.

Abscesses following tonsillectomy are more favorable than those following aspiration of foreign bodies such as pieces of metal, kernels of corn, and so forth. Metallic bodies particularly seem to have some inherent property of producing gangrenous abscesses. Abscesses due to bronchopneumonia are so often multiple that the prognosis is not favorable. If due to direct extension from the liver or subdiaphragmatic space the prognosis is fair, whereas it is bad if the extension has been from the mediastinum. If they are due to metastasis from distant foci, the prognosis is bad. It is very much better in acute than in chronic abscess, and in single than in multiple. Apical abscesses are more favorable than those located in the lower or middle lobes because the former drain more easily into the bronchus. It is, of course, better in multiple abscesses confined to one lobe or lung than in those involving both lungs. The prognosis must be guarded when hæmorrhage, even if only a trace, has occurred.

Less than one-fourth of the acute single abscesses will require surgery. Early operation for acute multiple abscesses is not warranted. Possibly one-third of the chronic single abscesses and one-half of the chronic multiple abscesses confined to one lobe may require operation. It is rare that a patient with either acute or chronic multiple abscesses involving both lungs is in a condition to stand operative treatment. In 3 such cases I have been obliged to operate because the main abscess attained such a size that the patients were *in extremis*. Two survived but were cured only partially. Perhaps early pneumothorax on the most involved side would give a better chance for relief in these bilateral cases.

The small encapsulated abscesses that are not connected with a bronchus should be carefully watched, and, if the patient continues to show signs of absorption, either pneumothorax or operation should be undertaken. Such abscesses act as dangerous foci of infection and the gravest sequela may follow absorption of pus from them. The prognosis should be guarded. All abscesses, due to a foreign body in the parenchyma and those to a foreign body in a bronchus that cannot be removed through a bronchoscope, should be operated on.

MEDICAL TREATMENT

Mix says: "There is no medical treatment for pulmonary abscess." Goldberg and Biesenthal say: "The treatment of acute lung abscess by medical agents, pulmonary inhalant antiseptics, posture and the like, carries with it so high a mortality and at best only an amelioration of symptoms with very few cured, that it might better be discarded for some surgical procedure."

Robinson says: "I early learned the necessity for expectant treatment in these cases." I would like to add a fervent amen to this last statement. Tuffier and Murphy both say that if the abscesses are draining freely through a bronchus, medical treatment should be thoroughly tried. Before any operative interference is considered, I believe practically every patient should be given a thorough trial on medical treatment as follows: rest in bed in the open air, frequent feedings of highly nourishing foods, such as milk, eggs, gelatins, custards, chocolate, cocoa, and so forth, and sodium bicarbonate from 100 to 120 grains in 24 hours to offset acidosis. The glycogenic function is reduced in all patients who have for some time been subject to active suppuration. To improve this, one glassful of 5 per cent glucose in water should be sipped every 2 hours during the day; postural drainage must be encouraged. Persevere with such patients until some position is found in which

free bronchial drainage is established. Once such a position is found, carefully explain to the patient the necessity of keeping the abscess free of pus and, as often as his general condition will permit, have him assume the posture. Particularly the last thing at night and the first thing in the morning, and during the night if he awakes he should attempt to evacuate the pus. Case 1 illustrates successful medical treatment for this condition.

Inhalations should be employed, not so much for their curative effect *per se* as to offset the odor, thereby improving the patient's mental outlook, and his desire for food. Stimulant cough mixtures may be taken. If there has been a hæmorrhage the patient's bleeding and coagulation times should be ascertained; if they are delayed, calcium chloride should be given intravenously.

The use of the bronchoscope has been advised by Meyer, Lynah, Jackson, Mayer, Mosny and St. Girons, Yankauer, and others. It has been employed to irrigate the cavity, to aspirate the pus and instill antiseptics, and merely to dilate the main bronchus leading from the abscess to allow spontaneous healing to occur. I do not believe that the use of the bronchoscope can be relied on as a routine method of treatment. Certainly every effort should be made to remove foreign bodies through it and many abscesses heal after the foreign body has been removed. It is possible that dilatation of the main discharging bronchus by establishing free drainage would increase the percentage of medical cures. I have always feared the possibility of infecting the healthy lung during manipulations with the bronchoscope and have preferred to avoid every possible measure that might allow the patient to aspirate pus into the healthy lung.

A four-hourly temperature chart should be kept and the patient watched carefully from day to day. So long as his general condition improves, nothing further should be done. If after a fair trial of this method, the temperature is still maintained, and the patient is not eating better, is not sleeping better, is having fever, or is not gaining in weight, and the amount of sputum persists, other measures should be considered.

Artificial [illegible] employed in certain types of abscess. Tewksbury, Goldberg and Biesenthal, Bazin and others report favorable results. I must confess that I have had little success with it. However, with a patient that is having severe hæmorrhage from a lung abscess, pneumothorax should be resorted to at once. If the abscess is small and well localized, I would employ pneumothorax. If, on the other hand, the abscess is large or multiple and the patient is producing a considerable quantity of pus, unless the condition is long standing and the lung over a wide area is probably firmly adherent to the chest wall, pneumothorax may do harm. When there is extensive necrosis of the abscess, the adhesions may tear away from the chest wall, pus will escape into the pleural cavity, and empyema result. In other cases it is conceivable that the collapse of the lung in a patient already emaciated and with little resistance might be attended with danger from syncope and from the exhaustion of the irritative cough that sometimes follows pneumothorax. In cases of small encapsulated abscesses without bronchial connection, pneumothorax should certainly be tried before surgery is instituted. In any case, so long as the patient is not holding his own or improving after the lung has been collapsed, surgery should be undertaken.

INDICATIONS FOR OPERATION

1. Operations should be undertaken for all patients who, after a thorough trial of medical treatment, are no longer improving or holding their own.

2. Early operation is advisable in all cases of fair-sized patent cavities surrounded by markedly fibrosed or calcareous walls.

3. Pneumothorax may be advisable in all cases of small, completely encapsulated abscesses not connected with a bronchus. If pneumothorax does not improve the condition, operation should be undertaken early.

4. After thorough medical treatment to put the patient in the best possible condition for operation, surgery should be resorted to in all cases in which an abscess surrounds a foreign body imbedded in the parenchyma,

or in which a foreign body in a bronchus cannot be removed through the bronchoscope.

5. Early operation is advisable for patients with very large abscesses even though the patient's general condition is fairly good, since there is a possibility that they will be drowned in their sputum.

6. There is a small percentage of patients who have developed very large abscesses and whose general condition is very bad, in whom drainage is urgently necessary, regardless of the great risk, because they produce such quantities of pus that they are in danger of drowning themselves.

Various methods have been employed for securing drainage. The earlier surgeons resorted to intercostal stab, cautery puncture, or trocar drainage through an interspace. Because they were not always successful in reaching the cavity through the interspace, resection of the overlying ribs was resorted to. The necessity of having firm adhesions over the abscess has been insisted on before attempting to drain the abscess. If adhesions were not present, irritating pastes, gauze packs, and suturing of the parietal pleura to the visceral have been resorted to in order to establish adhesions. In this connection, if any measures are to be employed to establish adhesions, I prefer a gauze pack. After freeing the parietal pleura sufficiently, the pack is placed and the skin flaps sutured over the gauze and left in place for from 4 to 8 days. There are certain objections to the suture method.

Very often the patient coughs, the needle tears a little in the parietal pleura, and the lung collapses. It is an easy matter to get the lung into expansion again but occasionally the surgeon overlooks the fact that the lung has collapsed and leaves it in collapse. I have seen surgeons in passing their needle through the lung open into the abscess, and I am sure empyema must have resulted in most of those cases. Distressing, even almost fatal, emphysema has occurred. On the whole, suture is unnecessary and prolongs the operation needlessly unless there is some urgent reason for opening the abscess at the first operation. If the patient is acutely ill, and drainage is urgent, it is much safer to drain an abscess through an area that is firmly adherent to the chest wall and the quickest and safest method of accomplishing this should be employed. However, the majority of patients with lung abscess stand operation well. I have found that a more deliberate and extensive operation than the ordinary resection of the overlying chest wall and drainage gives a better ultimate result with scarcely any additional immediate risk to the patient.

With all our methods of localizing and outlining abscess or abscesses in the lungs, I early realized that at operation hidden pockets or adjoining but distinct abscesses were often overlooked and only revealed at necropsy. While the stereoscopic plates and the fluoroscope are invaluable in localizing such abscesses, we could never be sure in the old operation that all areas were being drained. The exploratory needle is highly unsatisfactory and unreliable. It is many years now since physicians became convinced that in abdominal abscesses exploratory laparotomy was less dangerous than exploratory puncture. All physicians who have had experience with a number of thoracic cases must feel that the same is true in indeterminate thoracic lesions. I have not employed the needle for diagnostic purposes during the past 4 years except as a means of determining the nature of pleural collections.

Because of the uncertainty of localization of an abscess in the lung, because with the earlier operation through the adherent area of the abscess I had not drained all pockets, and because thoracotomy under local anæsthesia is so safe a procedure, I prefer to open the thorax widely, thoroughly palpate the lung and locate the abscesses, and establish drainage accordingly. The thorax can be opened and its contents explored as readily and with as little risk as the abdomen. Apart from those patients who are acutely ill, I prefer that adhesions be absent or at least be so few and so recent that they can easily be broken down if need be. A few adhesions act as a guide to the involved area of lung. Wills, in 1901, operated on 2 patients by opening the thorax widely, palpating and accurately locating the abscess, and draining. Murphy, in discussing Wills' paper, favored the operation. Ashhurst

Fig. 1.—V-30504. Multiple cavities.

Fig. 2.—V-[illegible]. Chest 3 months after operation. Patient well. Solitary abscess.

advised the same procedure, that is, wide exploration, palpation, and drainage. Except in patients so acutely ill that drainage through the adherent area was the limit of judicious surgery, the operation which I have employed for the last 3 years is as follows:

After the location of the abscess has been determined as accurately as possible, whether anterior, posterior, lateral, high, or low, peripheral or deep, the incision is planned so that the skin flaps completely expose the abscess and yet can readily be employed to close it ultimately. Beck showed the value of flaps in the closure of cavities following abscesses and empyema. For reasons that I have repeatedly pointed out, in my opinion, paravertebral anæsthesia associated, if necessary, with gas and oxygen, is the anæsthetic of choice in all thoracic surgery. The incision is made, if possible, in the first interspace below or above the adhesions or abscess. The intercostal incisions allowing easiest access to abscesses are: (1) the third or fourth interspace for abscesses in the anterior portion of the upper lobe, (2) the fifth interspace, carrying the incision posteriorly from the nipple line for an abscess in the middle lobe, and (3) the seventh or eighth interspace, carrying the incision posteriorly from the anterior axillary line for an abscess in the middle lobe (Fig. 3).

Occasionally, it is necessary to approach an abscess through the posterior aspect of the chest. It is usually possible to obtain sufficient room between the vertebræ and the scapula. If necessary, the scapula can easily be winged outward or inward without any permanent disability, if the muscles are properly sectioned and transplanted or repaired and if fixation is avoided by moving the arm and shoulder from the first. The typical intercostal thoracotomy is employed and the interspace opened sufficiently wide freely to admit the operator's hand to search for adhesions; if present they lead to the main abscess. The hand is swept over the lung, feeling for areas of hardening or softening. The hilus glands and the mediastinum are palpated. The experienced operator in a moment will detect changes in the consistency of the lung. When the extent of involvement is determined the

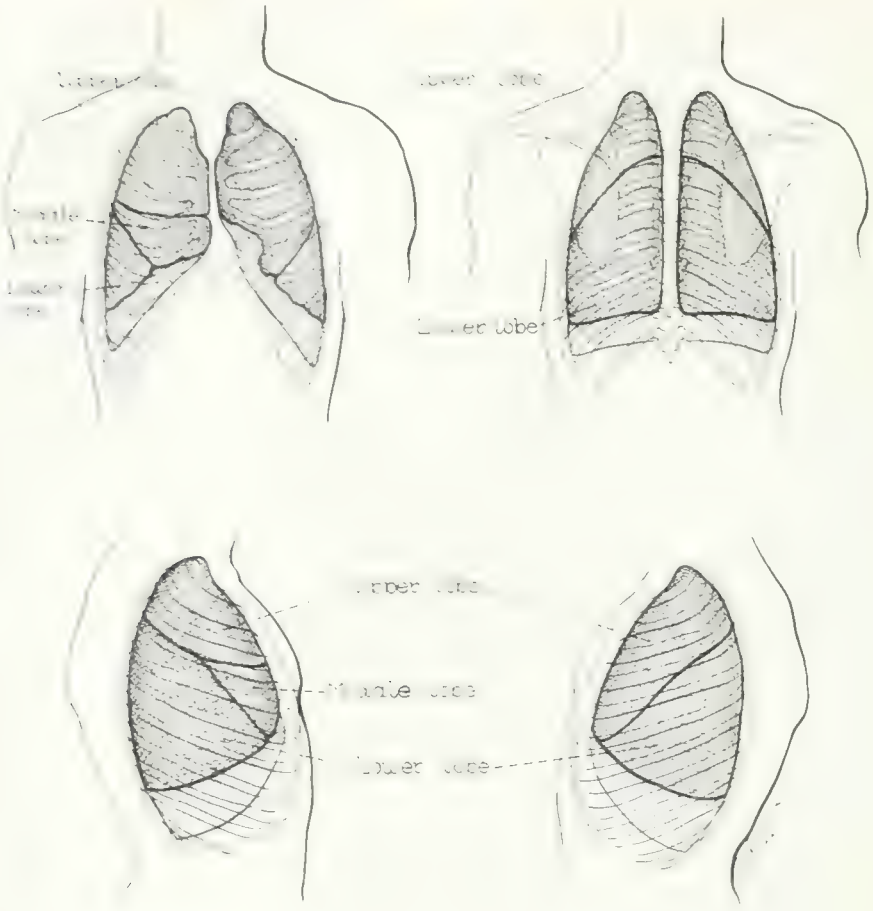


Fig. 3. Diagram of lungs showing the position of fissures in relation to the chest wall.

lung is brought up to the chest wall so that the involved area will be most easily exposed. The site of this is mapped out on the chest wall and flaps fashioned to expose that portion. After a sufficient amount of the chest wall has been removed, the lung is brought up and delivered through the opening so that the outer wall of the abscess is well outside the level of the chest wall (Fig. 4). It is then sutured there with twenty-day catgut. The first row of sutures includes the visceral pleura, the parietal pleura, and the intercostal muscles. A shoemaker stitch is employed and the first row of sutures should so closely appose the parietal pleura to the visceral that the pleural cavity is entirely shut off. If there is sufficient muscle available, and there usually is (either the pectorals, latissimus dorsi, or serratus magnus as a rule), a second row of sutures approximates the muscles to the visceral pleura over the first layer. A third row sutures the skin to the visceral pleura so as to overlay the second row and doubly overlay the first row (Figs. 5, 6, 7, and 8). If the abscess is very large and the patient has been producing a large amount of sputum by coughing, it may be wise to rub vaseline into the suture area and open the abscess at once. I have had one patient drown in his own sputum after the first stage and before the abscess was opened.

In most cases it is wiser to wait 3 to 4 days until granulations have formed. No anæsthetic is necessary to open the abscess. The entire

FIG. 1. Exposure of the upper lobe [illegible]

top of the abscess is excised with a scalpel; the cautery is not employed until the cavity is thoroughly exposed, all débris removed, and all tags cut away and ramifications of the abscess opened. The cautery gives a false security. Fair-sized vessels often are found in the walls of abscesses. The cautery sears them over temporarily and in the presence of infection or necrosis they may later open and bleed. It is safer thoroughly to expose the abscess with a knife or scissors, employ hot packs to control the bleeding and after thoroughly cleaning out the abscess, tie off the larger vessels and, if necessary, apply the cautery here and there to control oozing. Crush all bronchi and tie with catgut. It may be advisable at the first operation to dissect out, invert, and suture over larger bronchi (Fig. 9). After the cavity is thoroughly dry, pack it with gauze wrung out of glycerin and saline. (Sodium chloride 5 per cent, sodium citrate 0.5 per cent, glycerin.) This is a soft, bland dressing that is non-irritating, does not allow the gauze to become adherent, and sets up a mild osmosis from the surface of the lung. After 4 days the pack is removed, all tags are snipped away with scissors and a similar dressing carefully applied. Daily dressings are discouraged and every effort is made to avoid reinfection or additional infection. At the earliest possible moment, skin flaps are brought in to overlay and close the cavity. Usually by the tenth day this is possible. If all bronchi are closed the flaps will adhere more readily. Smaller bronchi may be cauterized within their lumen to the depth of 1 to 2 centimeters and the flaps applied directly over them. Even in the presence of considerable suppuration, flaps readily adhere and granulate into the lung tissue. A light pack of glycerin and saline is applied over the flaps to keep them uniformly adherent, and the

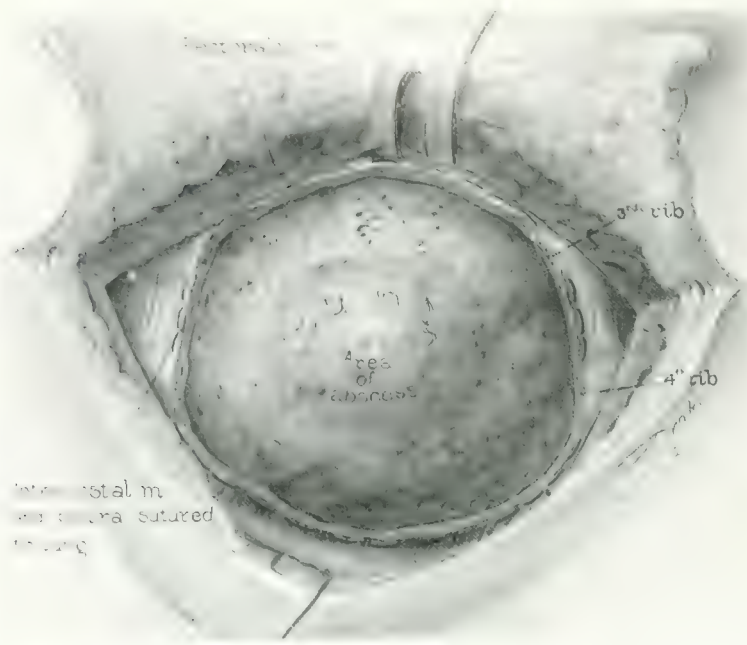


Fig. [illegible] Suture of the parietal pleura and intercostal structures to the lung.

dressing is left in position for 4 days, by which time the flaps are usually securely attached. By this method the danger of secondary hæmorrhage is reduced, the tendency to reinfection is lessened, and the repeated dressings and the long drawn-out convalescence of the old operation are avoided.

Whether the abscess is drained through a small opening in the adherent area or is widely opened, as I have suggested, irrigation of the cavity should never be practiced. Violent coughing often follows irrigation and infective particles may be carried to distant bronchi in the same lung or in the uninfected lung. In abscesses that have been opened by cautery puncture or blunt dissection, a few drops of 2 per cent formaldehyd in glycerin may be instilled through a catheter. It is hydroscopic, mildly antiseptic, and deodorant.

Resection *en masse* is possible in many small completely encapsulated abscesses. It is the operation of choice in a small abscess surrounding a foreign body imbedded in the lung. If the patient is producing sputum, there is a surrounding bronchiectasis or an open bronchus, and complete resection is not advisable.

Tuffier practiced an operation whereby the parietal pleura was freely separated from the chest wall and fat transplanted over it to exert sufficient pressure to collapse the abscess. Archibald has employed this method in apical tuberculous cavities. I believe this operation should be reserved for the latter type of case.

POSTOPERATIVE TREATMENT

Treatment after operation is important. The patient should be nursed in the open air, and forced feeding and the administration of alkalis and glucose should be continued. Patients should be advised not to swallow sputum; many patients do this unconsciously. As soon as the temperature falls to normal, the patient should be up and around; he should do light setting-up exercises and every possible means should be employed to get him back to health. If bronchial fistulæ have persisted, their early operative closure should not be attempted. It must be determined by the roentgen-ray and careful examination that there is no hidden pocket or area of necrosis left to maintain the patency of the bronchus, and then, apart from cauterization, no active

Fig. [illegible] first, intercostal structures second, pectoral muscles; and third, skin.

measures or closure should be thought of until the patient is in good health. Conditions in the chest, such as bronchial fistulæ, small intrapulmonary cavities, or small empyemal cavities, should not be tampered with, unless some good purpose is to be accomplished. Cerebral lesions and sudden death occur too often following such palliative measures. Plan, if possible, to do all that is necessary in one operation. For the first year or two, patients should be warned to avoid exposure, as they have a greater tendency to colds and pneumonia.

Codein or heroin in small doses may be necessary to control the troublesome cough that is sometimes more frequent for the first few days after operation. Heroin should be cautiously used, however. The patient in his exhausted condition may go to sleep and sleep for 11, 12, or 18 hours. If the cough has been completely controlled, a large quantity of pus may collect and in a violent coughing spell, the patient may be choked with pus, and aspirate large quantities into all parts of his lungs, and even drown himself. Case 2 illustrates the danger of this treatment.

[illegible]

Emphysema, sepsis, septicæmia, empyema, grave pneumonia, cerebral embolism, and severe hæmorrhage may follow operation. Emphysema is not a common sequela, but it does occur. Its treatment is expectant. Sepsis as a rule is confined to the adjacent skin edges, and is not serious, unless septicæmia develops. Staphylococcus pyogenes albus or staphylococcus pyogenes aureus particularly, and occasionally the streptococcus hæmolyticus are found in the blood of most patients who develop septicæmia from abscess of the

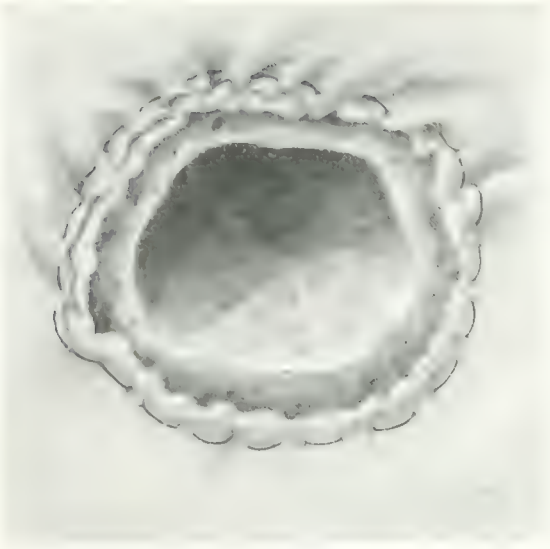


Fig. 7. Cavity of abscess and skin suture covering the first two rows of sutures.

lung. Empyema is a serious sequela and must be drained or dealt with by aspiration, regardless of the presence of the abscess. Empyema on the opposite side is a very grave complication and, if possible, should be dealt with by repeated aspiration. Pneumonia following operation for lung abscess is more often bronchopneumonia, but may be lobar. It is usually severe and the majority of deaths following operation, apart from those due to the shock of the operation itself, are due to pneumonia. Cerebral embolism, unfortunately, occurs from time to time and follows the same course as described under complications. Severe hæmorrhage occurs in a certain percentage of postoperative cases. Of 74 patients operated on by Tuffier, 4 bled to death. Patschke, Kraus, Garré, Green, and Lockwood have all reported deaths from postoperative hæmorrhage. I have not, however, had a death since I adopted the precaution of encircling the base of the

Fig. 9. Steps in the closure of a bronchial fistula.

Fig. 8. Flap imbedded in the abscess cavity.

abscess with purse-string sutures of twenty-day catgut, and tying all vessels. Small pulmonary arterial aneurisms occur in the processes of necrosis and cavitation, and care must be taken to ligate behind the cavity.

MORTALITY AND RESULTS OF TREATMENT

The mortality varies with the age of the patient, the cause of the disease, the extent of the lesion, the patient's previous general condition, and the treatment and general care (Table IX).

The death rate in children varies from 21 per cent as stated by Bassin, in 19 children, to 100 per cent as quoted by Baron in 7. Children and adults past middle life do not tolerate lung abscess well. Apparently the surgical mortality in children has been approximately 60 per cent, and the medical mortality 85 per cent. The mortality rate in children with acute single abscess should be less than 12 per cent, with thorough medical régime combined with pneumothorax if necessary. On the whole, the number that will be multiple, those that become chronic, and those that demand surgery, will raise the mortality to nearer 40 per cent.

In adults the death rate after medical treatment has averaged 58 per cent, after surgical treatment 35 per cent, and after medical treatment and pneumothorax 16 per cent. These percentages, however, cannot be translated literally to represent the true death rate. A careful study of the reported cases shows a wide variation in the selection of patients for treatment by medical régime, pneumothorax, and surgery.

Fig. [illegible] Abscess of the lung.

[illegible] taken.

Balboni reported two cures in 4 cases. Tewksbury reported six cures, two improvements, and two deaths in 10 cases following pneumothorax; and Goldberg and Biesenthal reported twelve cures, two improvements, and two deaths in 16 cases following pneumothorax.

On the other hand, Picot reported only 10 per cent of 133 patients cured with medical treatment; McKechnie reported one cure, and Rendleman one; Wessler and Schwarz reported that one-third of thirty postoperative abscesses in children cleared up spontaneously, and Clarke and Marine reported 4 of 21. Whittemore said that only from 6 to 10 of 100 patients get well without operation and of 21, 3 recover spontaneously. Kraus and Strauss reported spontaneous cures. Of 25 patients with abscesses due to lobar pneumonia seen by Laennec, 18 recovered after medical treatment. His editors, however, doubted the diagnosis in certain cases. McKinney reported 1 of 3 patients spontaneously cured. Holmes reported 1 case of his own of multiple abscesses in which the patient recovered on medical treatment; he collected 2 other such cases. Wessler reported [illegible] patients with abscesses cured, the duration of the abscess was not less than 3 weeks and not more than 6 months. Wasmer had six medical cures. Yankauer reported three cures in 15 cases with bronchoscopic treatment, and Lynah, Mayer, Mosny, and St. Girons, report cures by such treatment.

Of 1117[1] patients with abscess of the lung, 518 (46 per cent) are reported cured, 101 (9 per cent) improved, 47 [illegible] per cent improved but with a persisting sinus, 25 (5 per cent) not improved, and 373 (33 per cent) dead. The average medical mortality was 58.6 per cent. The average surgical mortality was 34.6 per cent.

These data, while interesting, distort the facts. Forty-six per cent of patients cured is higher than the average has been in the hands of careful observers who have a thorough follow-up system. Lord states that

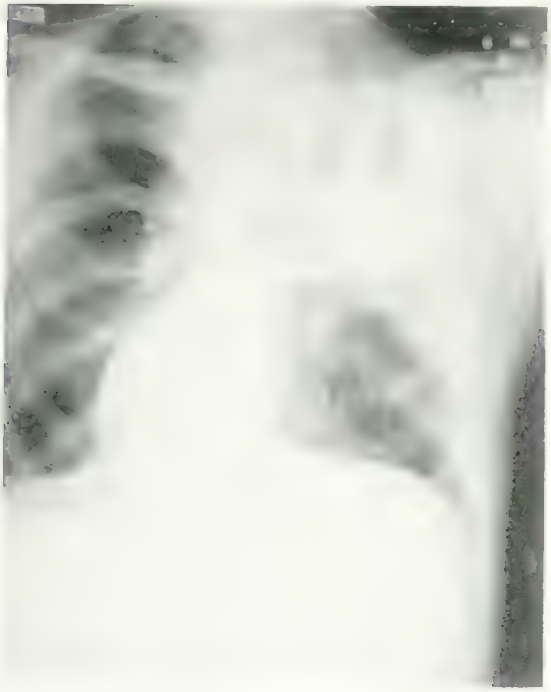


Fig. 12. (A231063.) Putrid gangrenous abscess of the right upper lobe.

only 10 per cent are cured by surgery. I believe that many reported cures in the collected cases would have been more properly listed as improved. Again, 2 per cent improved but with fistulæ, is 2 per cent of the whole, but 11 per cent of those treated surgically.

In considering the mortality and results of treatment, I wish to direct attention to this group of 54 patients and particularly to the 27 treated medically. These cases were, on the whole, long standing and serious. Forty-nine were chronic; the average duration of symptoms was 19 weeks before examination. Twenty-five were of the type usually classed as gangrenous abscess. In 16 the complications were almost as serious as the disease itself. Of the 27 patients treated medically, 16 are cured, 3 improved, 5 not improved, and 3 dead. Of the 5 patients not improved, in 1 the diagnosis is uncertain. It may be a sarcoma, the patient is still under observation; in 1 the patient has multiple abscesses, is extremely ignorant, and refused to stay for treatment; in 2 there is extensive associated bronchiectasis; in 1 the patient attempted to carry out the treatment at home. Of the 27 patients treated surgically, 13 are cured, 3 improved with fistulæ, and 11 are dead.

An analysis of the 11 deaths shows the extent of the disease before coming for treatment, and the impossibility of averting death in a certain percentage of late neglected cases.

The results are certainly better when the patients are hospitalized and under the constant care of a close observer. If medical treatment alone, or medical treatment with pneumothorax, is instituted, the patient must be carefully watched every day for signs of increasing toxic absorption. The signals must not be missed, nor the opportune moment for surgery. The greatest danger in medical management of these patients is that often the time is not recognized when medical treatment should give way to surgical; for that reason, once the condition has been diagnosed, the patient should be under the care of the surgeon, as well as under the constant attention of the internist.

ILLUSTRATIVE CASES

Case 1. (A303512.) Mr. F., age 59, on whom a radical Killian operation had been performed, developed a cough on the second day. The sputum became thick and foul, and progressive weakness and loss of weight followed. Pain developed in the right chest. There was some dyspnœa. The hæmoglobin was reduced to 55 per cent, the erythrocytes to 3,220,000, and the leucocytes increased to 14,800. Examination of the sputum did not reveal elastic tissue or tuberculosis bacilli. Roentgenograms showed an abscess of the right lower lobe. A slight retraction over the third space in front, cavernous breathing, cracked-pot sound and whispered pectoriloquy over the second and third interspaces in the middle clavicular line were noted. A diagnosis was made of abscess in the upper right lobe of the lung. Forty days after the abscess developed, the patient was placed on medical treatment and postural drainage. During the first 7 weeks he gained 30 pounds. His cough cleared up rapidly, but he maintained an evening temperature. After 13 weeks of treatment he returned to work entirely well. In answer to a questionnaire 15 months later he said he was in "perfect health" (Figs. 10 and 11).

Case 2. (A321063.) Mr. A. H., age 50, registered at the Clinic June 26, 1920. He had been well until September, 1919, when he developed severe influenza from which he never entirely recovered. He was

Fig. 13. (A360675.) Abscess of the left upper lobe

Fig. 14. (A360676.) Healed abscess of the left upper lobe. This roentgenogram in Figure 13 was taken.

able to work and be around. In March, 1929, he had a bad cold. His cough increased, he lost appetite and strength. He began to have a daily temperature of 99° to 102° with occasional chills. About the third week the sputum increased in amount and became so foul that the family could not stay in the room with him. He coughed up half a cupful at a time and large quantities in 24 hours. Posture did not increase the amount of sputum; he spat up some blood from time to time. Later he developed pain over the right chest anteriorly. He perspired profusely at night, and became so weak that he was confined to bed. He had lost 40 pounds in weight.

The abscess had been well established for 3 months when he was brought to the Clinic. He was pale, emaciated, extremely weak and had a frequent racking cough. He produced large amounts of extremely foul sputum with each coughing spell. He had marked clubbing of the fingers, and watch crystal nails. He was dyspnœic and had pain continually over the right chest anteriorly. His hæmoglobin was 63 per cent, erythrocytes 3,640,000, and leucocytes, 17,800. The sputum was negative on repeated examinations for tuberculosis bacilli and elastic tissue. Marked retraction over the second and third interspaces on the right side anteriorly was noted. There was an irregular area over the second and third spaces or impairment on percussion, moist râles, whispered pectoriloquy, increased breath sounds, a suggestion of a cracked-pot sound, and a surrounding area of consolidation. Roentgenograms revealed an extensive abscess of the right upper lobe (Fig. 12). A diagnosis of putrid abscess of the right upper lobe was made. The patient was so exhausted by his trip to the Clinic that while operation was urgently indicated, it was considered necessary to put him at rest on routine medical treatment to improve his general condition. He was kept in bed in the open air for 4 days, glutted with highly nourishing food, sodium bicarbonate (120 grains in 24 hours), glucose by mouth and by rectum. He improved greatly in the 4 days and operation was undertaken.

Paravertebral anæsthesia was employed. The thorax was opened through the fourth interspace. The upper and middle lobes were firmly adherent to the chest wall anteriorly and laterally as far as the postaxillary line. The upper and middle lobes felt solid, like a neoplasm. However, the adhesions were so firm that palpation was limited. A portion of the third rib was excised and the visceral and parietal pleura sutured well below the area of lung involved. The upper skin edge was sutured back, the abscess to be opened 48 hours later. Because of the particularly distressing cough, the interne was instructed to give one-twelfth of a grain of heroin at intervals of one and one-half hours until the cough was under control. After three one-twelfth grain doses over an interval of 6 hours had been given, the patient went to sleep at 11 p.m. and slept until 10 a.m. without coughing. He had been in the habit of coughing violently at least every 20 to 30

minutes at night. At 10 a.m. he awakened, complained of pain over his chest, moved a little and began to cough. A large amount of foul pus gushed from his mouth; he gagged and choked and became intensely dyspnœic. The interne was called at once and believed the patient had developed a pulmonary embolus. On being called, I was satisfied that he had aspirated a large quantity of pus and was drowning himself in it. He was extremely dyspnœic and cyanosed; breathing was very labored, and he died shortly after. Necropsy revealed extensive large multiple abscesses approaching a localized sacculated bronchiectasis. The bronchial tubes in both lungs were full of thick, foul pus containing much epithelial débris, shreds of lung tissue, and calcareous particles.

Three mistakes had been made in the treatment of this patient.

1. Although he was extremely ill and the area of involvement was extensive, he improved remarkably in 4 days of active medical treatment. He should not have been operated on until the maximal improvement had been reached.

2. If patients have extensive cavities, produce large quantities of sputum, and are acutely ill, drainage is the prime object in operating, and should be secured by the quickest and most direct method. Following operative interference with the pleura, troublesome cough often persists for a day or two. For that reason the cavity should be opened at the first operation in such cases.

3. While steps must at times be taken to control distressing cough in patients already greatly weakened, under no conditions should narcotics be administered to the point of producing sleep so deep that the patient does not cough. Large quantities of pus must not be allowed to accumulate within the lung.

Case 3. (A360675.) Mr. H., age 28, who registered in the Clinic June 7, 1921, had been ill for 11 weeks, during which time he had lost 40 pounds in weight. He had had hæmorrhages for about 2 weeks and was pale and emaciated.

Examination revealed an enormous abscess of the lung involving the upper right lobe (Fig. 13). The temperature was 103°. The leucocytes numbered 15,400. The pulse-rate varied from 112 to 120. There were signs of a large cavity in the upper lobe of the right lung with consolidation below.

The patient was put to bed in the open air; he was inclined to the right side, with ice-bags over the entire upper chest. He expectorated about 600 cubic centimeters of foul-smelling, reddish-brown sputum a day. Forced feeding was instituted and he was given a glass of 5 per cent glucose solution to be taken over a period of 2 or 3 hours, and 120 grams of sodium bicarbonate in 24 hours. Hæmorrhage of about 500 cubic centimeters occurred on the third day after admission and on three other occasions in variable amounts within the next 10 days. After the second hæmorrhage an attempt was made to collapse the lung with oxygen, but the patient was so acutely ill that he could not be moved in order to have a roentgenogram made for the determination of the extent of collapse. His condition was so serious that transfusion was considered. His coagulation time of 9½ minutes was reduced to 3¼ minutes by the administration of calcium chlorid (10 cubic centimeters of a 10 per cent solution intravenously) on three occasions at intervals of from 5 to 6 days. The patient continued to spit up dark blood-stained sputum for 4 weeks. However, he did not have any further active hæmorrhage and gradually improved in health and was up and about by the middle of July. August 1 he was dismissed from our care entirely well (Fig. 14).

Three years earlier I would have considered this type of case urgently surgical. However, a patient with such an extensive abscess and so acutely ill belongs to the group in which the mortality rate following operation is high. Other cases similar to his have convinced me that well-controlled medical treatment should be tried out before an operation is undertaken. An interesting feature of this case is the development of a large pyogenic abscess without any demonstrable etiology.

CONCLUSIONS

1. Contrary to the opinion of the early writers that abscess of the lung is a common sequela of lobar pneumonia, a survey of the reported cases of the last century would lead us to conclude that it is a rare sequela.

2. By lowering the resistance in the lung tissue itself, the pneumonias (lobar, broncho, and influenzal) predispose the patient to the development of lung abscess following pyogenic infection.

3. Lung abscess occurs more often between the years of 25 and 40. It is three times as common in males as females; it occurs three times as often on the right side as on the left, and about twice as often in the lower lobe as in the upper. Three out of four are peripheral and involve the pleura, and one out of four is multiple.

4. It must be borne in mind that recently

a high percentage of lung abscesses has been the result of neglect or mismanagement on the part of the nose and throat surgeons, the oral surgeons, and the dentists. Such neglect or mismanagement is manifested in the selection of the anæsthetic, and in not keeping the patient's head low, and in not taking sufficient precautions to prevent the patient from inhaling foreign matter. Such a sequela may be avoided by (1) employing a local anæsthetic whenever possible in surgery of the mouth, nose, and throat, and in teeth extraction; (2) keeping the head low during such operations if a general anæsthetic is employed, until the patient has thoroughly aroused from it; (3) taking care to prevent blood and mucus from accumulating in the throat and being aspirated; and (4) better hæmostasis in such work.

5. The diagnosis depends on the history, the amount, and nature of the sputum, the roentgen-ray, and the physical examination.

6. A study of results in these cases has led me to conclude that surgery should not be employed as soon as the diagnosis has been made except as indicated. The mortality has been unnecessarily high in many instances. Instead, thorough medical treatment, with postural rest and drainage should be instituted. When this fails, pneumothorax should be produced in selected cases, and surgery reserved for those patients who do not respond to the other two methods.

7. The exploratory needle should not be employed.

8. When surgery is decided on, paravertebral and local anæsthesia, if necessary with gas and oxygen, should be used, and in the majority of cases a more deliberate, extensive, and logical operation should be planned than resection of the chest wall over the abscess, and cautery or blunt puncture of the abscess.

9. If the patient's condition is such that extensive operation would carry too much risk with it, resection, blunt puncture, and exploration of the abscess with the finger, should be the limit of surgery.

10. The surgeon, physician, and roentgenologist should be intimately associated in the diagnosis and care of these patients.

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MALIGNANT PAPILLOMA OF THE KIDNEY

By WILLIAM EDGAR DARNALL, A.M., M.D., F.A.C.S.

MALIGNANT papilloma of the kidney seems to be a very rare condition. The first case reported in this country was by A. O. J. Kelley [illegible] in 1[illegible]. Since that time there have been but 18 cases reported in America while the foreign literature contains a total of 38 cases. The American cases have been reported by Babcock (2), Watson and Cunningham [illegible], Lower (4), E. S. Judd (6), Hyman and Beer (5), C. H. Mayo (7), Stevens (8), and Goldstein (9), two cases by Kretschmer (10), three by Braasch (12), one each by Miller and Herbst (11), and McCown (13). There are two unreported cases by Burford (14), of St. Louis, and Parmenter (14), of Buffalo.

McCown in reporting his case made a very thorough study of the literature. He presents abstracts of 46 cases including the 38 foreign cases and his own. The total number of cases on record up to date is 56. To this number the writer adds below the fifty-seventh case. McCown's very thorough search of the literature and the report of his own case are to be found in the *Journal of the American Medical Association*.[1]

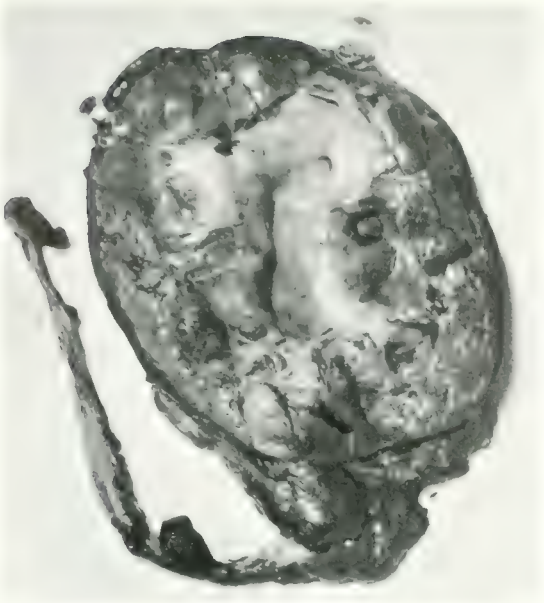
From an analysis of the cases thus far recorded the incidence of papillary epithelioma is more common in males than females in the proportion of two to one. Ages vary, the youngest being a young boy and the oldest a woman of 86. The etiology is unknown. Some authors are inclined to ascribe as the cause, inflammation, others stone. The tumors vary in size from multiple small, isolated, bud-like growths to a single, large, cauliflower mass filling the renal pelvis and producing as it grows destruction of the kidney parenchyma.

The tumor may start in the kidney and remain localized, but the striking tendency is to involve secondarily, either by direct extension or by implantation, the lower urinary tract. Of the cases reported, 25 showed involvement of the ureter while in 18 the tumor had invaded the kidney, ureter, and the bladder. The symptoms vary considerably with the [illegible] of the tumor and the associated pathology. Hæmaturia is the most constant sign. It is usually intermittent in character and may vary in severity from a slight cloudiness to a copious hæmorrhage. Pain is more or less inconstant but radiates from the kidney down the loin.

If the symptoms are not interrupted by surgical treatment, they may extend over quite a period of years. In the case reported by the writer, which was inoperable on account of the age and feebleness of the woman who was 82, the symptoms persisted for 6 years. Usually however, termination is seen relatively early. In adults especially, all cases showing intermittent hæmaturia and pain in the kidney region should suggest this condition. It is quite possible that some of the cases diagnosed as essential hæmaturia may be of this type when run down to their last analysis. Certainly this condition should be suspected if the roentgenograms are negative for stone, if there are colic-like attacks of pain radiating along the course of the ureters, if there is a diminished or absent function of the suspected kidney and if there is a palpable mass in the loin. In addition to this, if cystoscopy reveals a papilloma of the bladder or the ureteral orifice, and the pyelogram reveals a filling defect in the pelvis of the kidney and the urine contains unidentified epithelial cells, the presence of a papillomatous tumor is well-nigh certain.

Judd regards the papillary structure as proliferating epithelium of the renal pelvis. The exact nature of the tumor seems to be based on the appearance of the epithelial cells within the connective tissue beneath the tumor. Papillary tumors of the pelvis of the kidney are usually, if not always, multiple. These neoplasms are divided by Judd into three classes: (1) the simple papillomata which show throughout their entire development and evolution the char-

[1] J. Am. M. Ass., 19[illegible] lxxv, Oct. [illegible]



Specimen showing right kidney and ureter

acteristics of all such tumors; (2) the epithelial papillomata which almost immediately show the characteristics of malignancy; and (3) those tumors which apparently change from a supposedly benign to a malignant growth. For practical purposes it would seem best to credit malignant tendencies to all of these papillomata and treat them in a radical manner.

From the standpoint of treatment, the cases of renal papilloma may be divided into two classes: those with and those without involvement of the bladder. In all cases nothing short of complete removal of the affected kidney and as much of the ureter as possible should be done. If there should be implantation in the bladder, fulguration may be done later. If, on the other hand, fulguration should be done on bladder papillomata and the trouble higher up in the ureter or the kidney is overlooked, it is easily seen that nothing is accomplished and that endless trouble may ensue.

The following case brings the total reported cases up to 57.

Mrs. C. K., age 82; the mother of six children; thin, anæmic, and feeble. She has never been robust but has suffered from invalidism more or less all her life. She has an old history of nephroptosis of the right kidney. About 4 years ago the writer was called, the condition was explained, and he was asked to push up the kidney in place as it had come down by reason of the journey from her home in Brooklyn to Atlantic City. She stated that for 2 or more years she had suffered from intermittent hæmaturia and that her Brooklyn physician relieved her discomfort when the kidney came down by replacing it. On attempting to carry out her wishes I discovered a mass in the right loin about the size of a large grape fruit apparently elongated at both ends. It was more or less movable and was pushed up to a higher level under the liver. The next day she began to bleed and this continued for ten days. My impression was that the mass was a hydronephroma.

The patient's heart, lungs, and circulation were normal, blood pressure 110–85. She was quite feeble and resisted suggestions of cystoscopy and X-rays to the end. She was under my observation most of the time for a period of four years. Bleeding would sometimes last for several weeks at a time and then cease. During the intermissions she would be able to be up and about the house. The last year of her life, however, was spent practically in bed. It seemed rather unusual that during the latter months of her life the attacks of bleeding were less frequent nor did they last so long when they did occur. During my observation of her case there were two or three distinct attacks of ureteral colic. One day she passed an unusually large amount of urine and on examination the mass in the loin had disappeared. It did not return. There is no doubt but that this mass was a hydronephroma.

From time to time there were attacks of gastric and intestinal trouble, and an occasional rise of temperature a degree or two. The patient gradually failed and died on November 8, 1921.

Autopsy: Only abdominal examination permitted. The stomach was normal, the gall bladder thickened and distended showing the presence of an old cholecystitis, but there were no stones in it. There were old adhesions about the pyloric end of the stomach, the duodenum, and gall bladder. There were no enlarged glands and no involvement of the intestines. The pelvic organs showed no gross pathology, but were atrophied. The left kidney and ureter were normal. The bladder was normal except for some small gravel-like concretions. There was no evidence of cystitis or of papillomatous implantations. The right kidney was but slightly larger than normal. The pelvis was overdistended and the ureter bluish in color and about four times its normal size. On splitting the kidney and ureter open, the pelvis of the kidney as well as the ureter were smooth and showed no gross lesions, but at the apex of many of the pyramids of Malpighi were found beautiful little tufted cauliflower masses. In the pelvis was an organized blood clot.

This kidney was submitted to Dr. John A. Kolmer, professor of pathology at the University of Pennsylvania, who has given the following

report: "The histological examination of the kidney shows the presence of a papilloma in the pelvis which has undergone malignant change. The correct designation should be epithelioma of the pelvis of the kidney. This growth is fairly well circumscribed with fibrous tissue, and for this reason gives a good prognosis on account of its slow growth. In general the kidney shows chronic interstitial and glomerular nephritis."

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PARABIOSIS AND ORGAN TRANSPLANTATION

BY ISIDOR KROSS, M.D., [illegible]

THE problems concerned in tissue and organ transplantation have interested workers both in the laboratory and in the operating room. In the earlier period failures were encountered as a result of improper technique, lack of asepsis, etc., but all these factors have now been eliminated, and still there is the insurmountable obstacle presented by the absorption of the graft. As a matter of fact, where the technique is flawless and the asepsis beyond question, there have been successful autotransplants of entire organs (1); but, as soon as homotransplants were attempted, with the same skill and care, the result was almost invariably unsuccessful (2). Knauer reports successes in his ovarian transplants; heterotransplants have always failed to grow. These latter cases were characterized by the greater rapidity and intensity with which the graft was either absorbed or thrown off as a necrotic mass (3). All results so far lead to the conclusion that the graft acts as any foreign body does and meets with the same treatment from the host that any foreign invading body receives. The consensus of opinion is that chemicobiologic factors are responsible for these phenomena of lysis and absorption of the graft. Just what the differences are and how they can be rendered innocuous are the problems that confront investigators of this branch of surgery.

Differences in the "chemistry" of individuals are not so marked in the lower animals as in the higher. In fact, in those animals characterized by biologists as low in the scale of evolution, homologous transplantation is almost invariably successful, and even heterologous (4) grafts are not unusual. In plant life, this fact is well illustrated by the seedless orange, a sport propagated wholly by grafting. These chemical differences can be greatly intensified by injecting tissue emulsions prior to the actual transplanting (5).

The extremely intimate connection between the two individuals of a parabiotic pair is very clearly shown by the work of those who have studied this subject. Morpurgo succeeded in keeping alive a pair of rats for more than 40 days after he had performed a bilateral nephrectomy on one of them. In his series, the kidneys of the non-operated upon animal always showed a distinct compensatory enlargement. Sauerbruch and Heyde (7), showed that antibodies, agglutinins, etc., could be recovered in one animal after its partner had developed either active or passive immunity. In the case (8) of two sisters (who were born parabiotic) it was noted that when one became pregnant the breasts of the other were hypertrophied and filled with

[illegible]

secretion. Jehn (9) by means of parabiosis prolonged the life of animals in which he had produced experimental uræmia. These instances are cited to show the extremely intimate relationship of the biological processes in the two individuals of a parabiotic pair.

The theory upon which the present study is based consists in the conception that a parabiotic union removes the chemico-biologic differences between two animals of the same species and makes the tissues of a graft taken from one of these animals bear the same chemico-biologic relation to the host as do the host's own tissues.

In these experiments, young adult rats of approximately the same age and weight were employed. The peritoneal cavity of one animal was opened by an incision made in the flank extending from the lowest rib to the pelvis. A similar incision was made in the other flank of a second animal. The two were then placed side by side so as to bring the incised surfaces adjacent to one another. These two stomata were closed, as are the stomata in the performance of a gastro-enterostomy. The peritoneum and muscle were sutured in one layer, the fascia and skin individually, thus making three layers. In only very few instances did these layers fail to hold. The most frequent fatal complications were intestinal obstruction, pneumonia, and undernutrition with starvation of one of the pair. A frequent minor complication was an infection of the skin, which, however, always healed without any untoward results.

Ten days after the parabiotic operation, the graft itself was transplanted. This interval allowed for complete healing and firm union of the first operative procedure. Half of one lobe of the thyroid gland was excised and inserted into a muscle pocket in the anterior abdominal wall of the other animal. This pocket was always prepared prior to the excision of the thyroid in order to reduce to a minimum any possible injury to the latter by drying or too much handling. This pocket was then closed in two layers, muscle and skin. Closure of the neck wound completed the operation. During this procedure the only complication that occurred was troublesome bleeding from the severed thyroid arteries, which now and then resulted fatally.

Forty-four pairs of animals were employed in the experiments. Of these, 3 pairs died before transplantation of the thyroid tissue, 5 pairs were lost, and 7 pairs were decomposed to an extent that made histological findings worthless. This left 32 pairs for study. Of this number, 12 showed absolutely no trace of the implanted tissue.

In order to have a standard of comparison, two series of autografts and homografts were made, and sections of the thyroids from the parabiotic animals were studied parallel with these. With the exception of the graft in rat No. 17982, all the grafts showed marked lymphocytic infiltration, with very little apparently healthy thyroid substance remaining. In other words, the foreign body reaction and the lytic processes on the part of the host were more marked even than those in the homograft, and very much more than those in the autograft. The parabiosis did not, therefore, neutralize the chemico-biologic differences; if anything it seemed to make them more intense. The exception noted above may have been the result of mere coincidence, that is, of similar or almost similar blood chemistry in the two rats.

CONCLUSIONS

Parabiosis does not inhibit those unknown agencies which, in so many instances, interfere with the success of homografts of highly developed organs, such as the thyroid.

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UTERUS DUPLEX BICORNIS

[illegible]

IN reviewing the literature on the subject of uterus bicornis, we find it frequently stated that this condition is [illegible] currence. Relatively only a small number have been reported. Rockey (1) reports that the index of the first sixty volumes of the *Annals of Surgery* make no mention of this condition. In Ashurst's *Surgery*, written about 40 years ago, Parlin, of Philadelphia, quotes [illegible] from the literature. Kelly's textbook on *Operative Gynecology*, published in [illegible] gives an illustration of a case. Another case is reported by Fisher in volume V of [illegible] *Surgery*. In the few textbooks and encyclopedias mentioning the condition, we usually find the description limited to a few lines.

The first case of pregnancy in the rudimentary horn of a uterus bicornis dates back of 1669, and was recorded by Mauriceau and Vassal. DeLee (2), in 1916, reported a collection of about one hundred cases of pregnancy in a rudimentary horn of a uterus bicornis. In reviewing the literature further, we find several cases reported since that date. One of the most interesting cases on record is reported by Scott and Forman (3), in which twin pregnancy existed in a horn of a bicornuate uterus, for 20 years. In this case they report three full-term pregnancies and three miscarriages which occurred during the period of pregnancy that existed in one horn. The pregnancy which lasted for 20 years was terminated by operation, at which time two lithopedians were removed. It is interesting to note in their report that this patient showed normal menstruation when the 20 years' pregnancy first occurred. Jackson (4) reports a case of bicornuate uterus, with pregnancy, which was operated upon for intestinal obstruction. Mention is made by Cornell and Earle (5) of a uterus bicornis unicollis with two ova implanted in one horn. This was diagnosed ruptured ectopic with fibroid. Broadhead (6) describes a case of pregnancy in the rudimentary horn of a bicornuate uterus; gestation occurred four times in the right horn and the fifth time the left horn was involved. Watkin[illegible] of uterus bicornis which came to operation because of a strangulated ovarian cyst.

There are many interesting factors in the subject of malformations of uterus. The literature enlightens us by showing that there are probably many such conditions that are never diagnosed. This is shown by the fact that operation often reveals anomalies that are not suspected. Reports show that [illegible] have been diagnosed as ovarian cysts, occasionally as uterine myomata, or even as ectopic pregnancy. In a case of uterus duplex bicornis, it is not difficult to make a diagnosis because the two openings in the cervix can be seen and frequently felt while making a bimanual examination.

It is of interest to note that in a great many cases of uterus bicornis that have been reported, there was a twin pregnancy in one horn. Probably there is a biological factor which may have an influence in causing this frequency of twin pregnancies in a double uterus. However, the anatomical structure and the physiological function are without a doubt a factor. In only a few cases reported was pregnancy occurred in both sides, and only one case was found where pregnancy existed in both horns at the same time. No twin pregnancies were reported in both horns at the same time.

Unfortunately the history of menstrual function has been overlooked in many of the reports. In Case 1 of our series, menstruation occurred each month during the gravid period of her first pregnancy. In such cases it is difficult to figure the time of conception. It was a mystery why monthly menstruation was present until the malformation of the uterus was discovered. We would conclude that the function and the anatomy of this uterus must have been more or less equally developed in both horns.

The classification of malformations of the uterus varies in nomenclature. In many of the cases reported one could not decide in what category the specimen belonged, no statement being made of a duplex or a single cavity in the cervix. Our cases were of the duplex bicornis type, there being two distinct cavities, each communicating with the vagina by an os. One case presented a perforation of the septum just above the openings into the cervix. In this connection we might make mention of a case which is very singular, however. Wardlow had a case some years ago where there was a uterus duplex bicornis discovered at the time of delivery, at term. It was a breech presentation with a prolonged second stage. Both lower extremities delivered, but there the progress stopped. After this condition remained for some time without progress, careful examination revealed a perforation in the septum with one limb through this opening, and the babe staying in this position on account of the unusual anomaly. The septum which formed the saddle for the babe was cut with scissors and spontaneous delivery occurred. A case was operated upon by Wardlow at the university clinic, which showed a uterus duplex bicornis. Thus four cases have come under our observation.

In malformations of the pelvic organs it does not always follow that symptoms must be present, interfering with the health of the individual. Yet, we know that when developmental anomalies exist there is a predisposition to infection and disease. This is frequently found in organs like the kidneys. Definite symptoms can be charged to congenital malformations of the uterus in some cases but they do not necessarily call for operative treatment. A septum in the uterus can be removed by one of the several methods mentioned by authors. This is not always necessary since the organ will perform its intended function to the degree desired.

Operative procedure is required when sufficient symptoms exist to cause the patient to suffer discomfort or where infections complicate the field. One does not desire to produce an artificial menopause in young women but certain cases require that this be done because the lesion is interfering with the economy of the individual. When hysterectomy is considered advisable, let us not forget that the ureters may be displaced and injury to them may result unless this fact is kept in mind. Upon opening the abdomen, one might be puzzled when he finds the rectovesical ligament, unless he is familiar with this structure; it was marked in one of our cases, forming two distinct pelvic cavities. The attachment extended from the fundus of the bladder to the rectosigmoid junction. In performing a hysterectomy, careful dissection is required, thus avoiding injury to the bladder, rectum, and ureters. The fascia is well formed in this ligament and one hesitates at first to sever the structure, fearing it might contain a diverticulum of the bladder, or an extension of the rectum.

It is well to know in cases of pregnancy if we are dealing with an abnormal uterus. Frequently in the duplex bicornis type or in a unicornuate uterus the musculature lacks the proper development, and the natural forces in delivery are unable to play their part. Thus a prolonged labor may result from lack of expulsive power. Also under such conditions the wall may be thin, and there is danger of rupture. Such cases may require cæsarean operation.

The development of anomalies of the uterus is frequently found in individuals that show other developmental changes. Schwarz (9) says: "Most cases of uterus bicornis show an abnormally broad pelvis, which would account for the failure of the muellerian ducts to fuse into normal adult shape." In our cases both women are tall and larger than the average female. Our pelvic measurements confirm the view of Schwarz, as both cases have increased pelvic diameters.

Case 1. Referred by Dr. Wyker, July 16, 1921. Mrs. W., age 35. When a girl she was large for her age but not strong. Menstruation began at 13 years of age, coming at 4 to 6 week periods. This irregularity has continued to the present time. She flowed 7 days, using 4 to 6 napkins. Last 2 years' flow lasted 4 days. Leucorrhœa since a child. With each period there is swelling of mammæ with soreness. Dysmenorrhœa has been present for about 2 years. Patient has bearing-down feeling in pelvis, and crampy pains in both ovarian regions lasting

Fig. 1. Case 1. Uterus duplex bicornis, showing the cornua with tubes attached. Septum is shown b[illegible] the two openings in cervix.

[illegible] into two distinct cavit[illegible]

through period. The pain and distress has been almost unbearable recently. As far as patient knows, she has never been pregnant. In the spring of 1921, two periods were missed, cause not known. The sexual function is somewhat abnormal, in that there is no excitement during coitus. A dyspareunic hymen causes some discomfort in this case.

Recently this patient has become very nervous and feels exhausted. For about 1 year, there has been vesical irritation with polyuria.

Physical examination was negative, except for pelvis. The uterus is retroverted. There is an anteroposterior septum in upper part of vagina, and on each side of this is a distinct os into the cervix. Further palpation shows the uterus to be divided, forming two distinct horns (uterus bicornis).

Laboratory notes. Blood count: reds, 4,600,000; white, 9,000; polymorphonuclears, 51 per cent; small lymphocytes, 36 per cent; large lymphocytes, 9 per cent; and mononuclear, 4 per cent. Urinary examination, negative.

Operation. Excision of dyspareunic band. Dilatation of each uterine cavity and packed with iodine gauze. Both ovaries resected. Pan-hyster[illegible]my with a double salpingectomy was performed.

Case 2. Referred by Dr. Neiswander, June 6, 1920. Mrs. S., age, 30 years. Patient was a well-developed and healthy individual, until recent trouble occurred. Menstruation began at the age of 15 years, was regular 28-day type, flow from 7 to 10 days, copious, no pain. Patient has one child, 2 years of age. Delivery and puerperium were normal. During this gravid period patient menstruated regularly each month. The reason for this was puzzling at that time

[illegible] confined her to bed for about 2 weeks. During this [illegible] and May she had occasional bleeding from the [illegible] the discharge was marked. On June 10, [illegible] patient had a chill and temperature of 100°, pulse 118. This was accompanied with cramp-like, intermittent pains in middle of lower abdomen and pelvis. The bloody discharge was profuse.

Blood count: red, normal; white, 18,000; polymorphonuclears, 90 per cent. Urine, negative. A diagnosis of inevitable abortion was made. Pelvic examination revealed a uterus duplex bicornis, two [illegible] of the septum, large enough to admit the [illegible] ¾ inch above the external os. The two cornua were readily palpated. The cervix was dilated and from the right horn two fœtus were removed, both of which were 15 centimeters in length, and each one [illegible]

Patient came to hospital again March 21, [illegible] At this time an operation was performed for salpingitis. A pan-hysterectomy and a double salpin[illegible] was performed. [illegible] diameter was removed from the left ovary. The rectovesical ligament was well developed, thus forming two distinct pelvic cavities.

DEVELOPMENT

The muellerian ducts develop as epithelial thickenings near the anterior ends of the mesonephros. Later a groove appears, ventro-

lateral in the epithelium of the mesonephric fold. The lips of this groove close and form a tube. Cranially the tube remains open, thus forming the ostium-abdominale of the muellerian duct. The tube grows caudalward and eventually the duct opens into the urogenital sinus. In 20 to 30 millimeter embryos their caudal ends extend as far as the muellerian tubercle, a projection into the dorsomedian wall of the vesico-urethral anlage. The muellerian tubercle marks the position of the future hymen. Following this there is a fusion of the muellerian ducts, caudally, giving rise to the unpaired anlage of the uterus and vagina. The septum between the two lumina disappears usually during the sixteenth week. The muellerian ducts make two bends as they develop in the urogenital folds, their course corresponding to these folds. They consist of cranial and caudal longitudinal portions and a middle transverse portion. The caudal longitudinal portion is fused with its fellow to form the uterovaginal anlage.

The mesenchyma above the uterovaginal anlage differentiates into muscle and connective tissue of the uterus and the vagina. The wall between the transverse portions of the muellerian ducts bulges outward so that the cranial concavity is now convex. The transverse portions of the ducts form the fundus of the uterus and the vagina, developing from the uterovaginal anlage. The growth of the uterus is slow. It is practically the same length at birth as in a girl at 9 years. At the time of puberty, growth is more rapid, reaching a length of 72 millimeters at 18 years, nearly the maximum of the virgin uterus.

Failure of union of the muellerian ducts results in the different malformations. In the opossum we find the uterus duplex bicornis, cum vagina duplici. In the squirrel and beaver, we find normally a uterus duplex bicornis. In the dog, hyena and sheep, there is a uterus bicornis unicollis. The ant-eater presents a uterus biforis, while in the birds there seems to be a unilateral development, forming a uterus unicornis. Various forms may develop as a result of an unequal development in the two sides. When both halves develop equally, menstruation and conception in both sides are possible. Pregnancy usually occurs in the better developed side. It is difficult to explain the various anomalies occurring in the derivatives in the muellerian ducts. In the normal mustelus antarcticus the uterus is divided into compartments. In oviparius monatremes the muellerian ducts do not fuse but remain distinct and open into the urogenital canals. We can trace the differentiation of the oviducts in the opossum. A dilated portion of each oviduct gives rise to a uterus. Each uterus communicates with the vagina by a distinct os. The uterus bicornis is found in carnivores and most ungulates, and the uterus simplex in primates.

SUMMARY

1. Malformations of the uterus are not uncommon, but relatively few in number are recognized.

2. Pregnancy may occur in both horns of a uterus bicornis.

3. Menstruation may occur during pregnancy in a bicornuate uterus.

4. Statistics show frequent occurrence of twin pregnancy in this type of uterus.

5. Malformations of the pelvis may or may not exist with anomalies of the uterus.

6. Reports of uterine malformations should give complete history of menstrual function.

7. Malformations of the uterus are frequently confused in diagnosing pelvic and abdominal lesions.

8. When doing a hysterectomy in malformations of the uterus, always be careful to avoid injury of a misplaced ureter.

9. The rectovesical ligament is confusing when first encountered.

10. Cases in this report are classified as given by Graves (*Gynecology*).

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DEPARTMENT OF TECHNIQUE

THE STRAIGHT VESSELS OF THE TERMINAL ILEUM

[redacted]

IT is my desire to call attention to the straight vessels of the terminal ileum as a hitherto undescribed, though definite, anatomical feature of this portion of the intestinal tube. Its value lies in the ability of the surgeon to recognize at a glance this particular and important part of the intestinal tube, namely, the last inch and a half of the terminal ileum, by recognizing

Fig. 1. [redacted] vessels are found present.

the straight vessels found only at this point in the whole of the intestinal canal as a definite and distinguishing feature.

From the pylorus downward in the small [illegible] point approximately one and one half inches from the ileocæcal valve, the visible vessels run at right angles to the long axis of the bowel passing up from the mesentery on each side of the convex surface to meet over the point opposite the mesentery. In the last inch and one half of the terminal ileum, there are, however, one, two, or three small straight vessels which come up from the anastomosis formed by the ileocolic and the right colic arteries, sending these branches upward from the ileocæcal valve just under the peritoneum and parallel to the long axis of the bowel for a distance of one-half to one and one-half inches or thereabout. These straight vessels, as shown in the accompanying illustrations, are definite end arteries and run immediately beneath the peritoneal coat of the bowel, whereas, the other blood vessels supplying the small bowel run between the mucosa and submucosa.

With regard to frequency of this finding, we have observed these vessels to be present, and they have definitely indicated to us this particular point of the small bowel, in one thousand successive laparotomies.

While there are many reasons for locating without difficulty the ileocæcal valve, the greatest use for this definite anatomical point is probably to be found in locating the appendix, using the last inch and one-half of the terminal ileum as a more definite and more ready guide to the base of the appendix than other methods of location such as following the longitudinal muscle bands of the large bowel.

CHOLECYSTECTOMY FOR CHOLELITHIASIS

BY ALFRED J. BROWN, M.D., F.A.C.S., [illegible]

THOUGH much has been done toward obviating unpleasant results and recurrences after operations upon the biliary tract and some progress has been made, we must still conclude that in the aggregate the results are not satisfactory. A considerable number of patients complain of symptoms referable to the upper abdomen after operation and a certain number of these require secondary operations for relief. The percentage varies with the individual operator but in all thus far reported is fairly large. The recurrences in the hands of the average surgeon are probably of greater number than those reported from the large clinics as he is not in a position to select his cases and as a rule does not operate upon his patients until the disease is well advanced and the pathology present greater in amount.

The causes given for the necessity for re-operation are mainly adhesions forming after operation and stones in the ducts either overlooked at the time of the primary operation or subsequently formed. Occasionally the hepatic or common ducts are injured at the primary operation and the subsequent operation is necessary to do away with the resulting obstruction of the biliary passages causing jaundice with its train of disagreeable symptoms. With this class of unpleasant results discarded there remains still a fairly large percentage of cases in which the result is not satisfactory. No definite point can be found but the patients are not up to par and complain of indefinite gastric and abdominal symptoms. There is no sufficient indication for another operation but the patients are not cured and the result must be classed as unsatisfactory with no relief promised by further surgical interference. This is the most difficult type of case to manage and care for. The patients have been relieved of the mechanical condition from which they suffered and all symptoms referable to that mechanical difficulty have disappeared but in their stead is left a complex of indefinite symptoms for which a definite removable cause cannot be located. This condition of affairs has justly given rise to considerable skepticism both among the laity and the medical profession as to the ultimate value of surgery upon the biliary tract. The result is that the operation is postponed as long as possible and cases do not reach the surgeon until [illegible] cure is rendered more difficult.

These [illegible] disturbances in the physiology of the upper part of the gastro-intestinal tract are due to some interruption of the nervous mechanism by which the various integral parts of the complex are correlated in their action. In order that gastric and upper intestinal digestion may proceed in a normal manner, there must be a harmonious and governed action of the stomach, liver, duodenum, and pancreas. Lack of proper action of any one of these organs with relation to the others will disturb the proper functioning of the upper intestinal tract.

Embryologically the point of origin of the biliary tract is situated in the most complex part of the human economy and the liver is one of the most important organs of intra-uterine as well as extra-uterine life. The gall bladder develops from a bud of the fore gut, the original site of which remains as the papilla of Vater situated in the second portion of the duodenum. This hepatic anlage develops in the folds of the ventral mesogastrium, being connected behind, with the gut by the biliary tract, representing the original stalk of the hepatic bud; with the arterial system by the hepatic artery and with the venous plexus of the gut by the omphalomesenteric vein which subsequently forms the portal vein (Fig. 1). Early in embryonal life the umbilical vein leaves its position in the body wall to proceed to its intra-abdominal position passing along and defining the lower border of the ventral mesogastrium finally to enter the liver at the transverse fissure and break up into its radicals. Accompanying the structures as they pass through the mesogastrium into the liver are the branches of the sympathetic nervous system and the lymphatics emerge from the liver at the same point. The function of the sympathetic nervous system in this location is to form the connecting link between the various organs which develop from this part of the gastro-intestinal tract and assume different positions as development proceeds. There is also a connection between the hepatic plexus of the sympathetic and the left vagus nerve which traces a direct connection between that plexus and both the superficial and deep cardiac plexus by which a pathway is established for impulses which co-ordinate cardiac action with that of

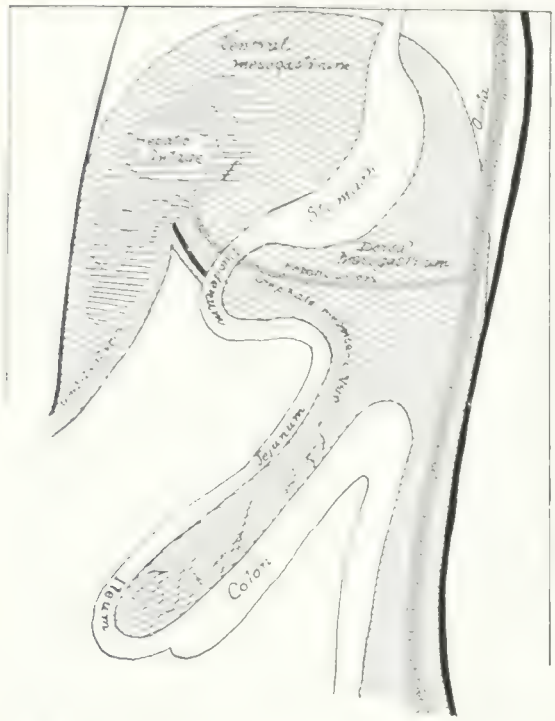

Fig. 1. Lateral schematic view of early stage of development showing the various connections of the developing liver and biliary systems. Branches of the sympathetic nervous system accompany all the blood vessels.

digestion in adult life. It can be seen what an extremely important part of the human economy physiologically this inferior border of the ventral mesogastrium represents in both intra-uterine and adult life.

With the positional changes which occur in development, that portion of the ventral mesogastrium between liver above and in front, and pyloric end of stomach below and behind, assumes a transverse position and lies in a vertical plane constituting the right portion of the gastrohepatic omentum. Its right border limits the anterior margin of the foramen of Winslow and between its leaves lie the hepatic and cystic ducts with the beginning of the common bile duct, the hepatic artery with its cystic branches, the portal vein, the hepatic plexus of the sympathetic nervous system, and the largest of the lymphatics draining the liver. The fibers of the hepatic plexus parallel and partly surround the cystic and hepatic ducts, and a complete division of the gastrohepatic omentum at this point severs the nerve connection between a portion of the liver above and the pyloric end of the stomach, upper duodenum, and pancreas below. The importance of these structures, especially the sympathetic plexus, in the proper regulation and co-ordination of hepatic function with the function of the other organs cannot easily be overestimated, and it is this part of the body that the surgeon must attack in his operative procedure in order to reach the lower portion of the gall bladder and the biliary ducts.

From the above considerations it would appear that a properly performed cholecystectomy is an operation of extreme delicacy calling for minute and careful dissection to free the cystic duct and arteries from the surrounding structures before ligating and dividing them. The operation as usually performed, drawing the gall bladder upward and dislocating the liver, locating the cystic duct and placing a clamp on it, including in the clamped structures the gastrohepatic omentum, is a dangerous procedure for in this manipulation those branches of the hepatic plexus which accompany the cystic duct and cystic arteries are bound to be divided and the chances are that many of the branches to the right lobe of the liver will likewise be divided. Those branches which pass downward along the superior pancreaticoduodenal artery are also in danger and if these are divided the connection between the liver and pancreas through the sympathetic system is broken. With this broken the co-ordination between stomach, duodenum, pancreas, and liver is impaired, and there results an independent action of the liver cells uncontrolled by the stimuli which normally reach them from the other organs. The consequence of this is a disturbance in the physiology of the upper part of the digestive tract which gives rise to the vague and indefinite symptoms complained of by the patient. An operation of this character relieves the patient of the mechanical difficulty but because of the injury to the sympathetic system has caused a disturbance of the physiology of the upper part of the digestive tract which is irreparable and gives rise to unpleasant symptoms.

These symptoms can be avoided by a carefully done cholecystectomy which may be performed either from the fundus of the gall bladder toward the cystic duct or in the opposite direction. If the gall bladder is distended it is usually a simpler technical procedure to start the removal at the fundus. If, on the other hand, the gall bladder is small and contracted the gastrohepatic omentum can first be opened and the cystic duct and arteries dissected free from surrounding structures before they are divided. In either case the peritoneum covering the gall bladder should

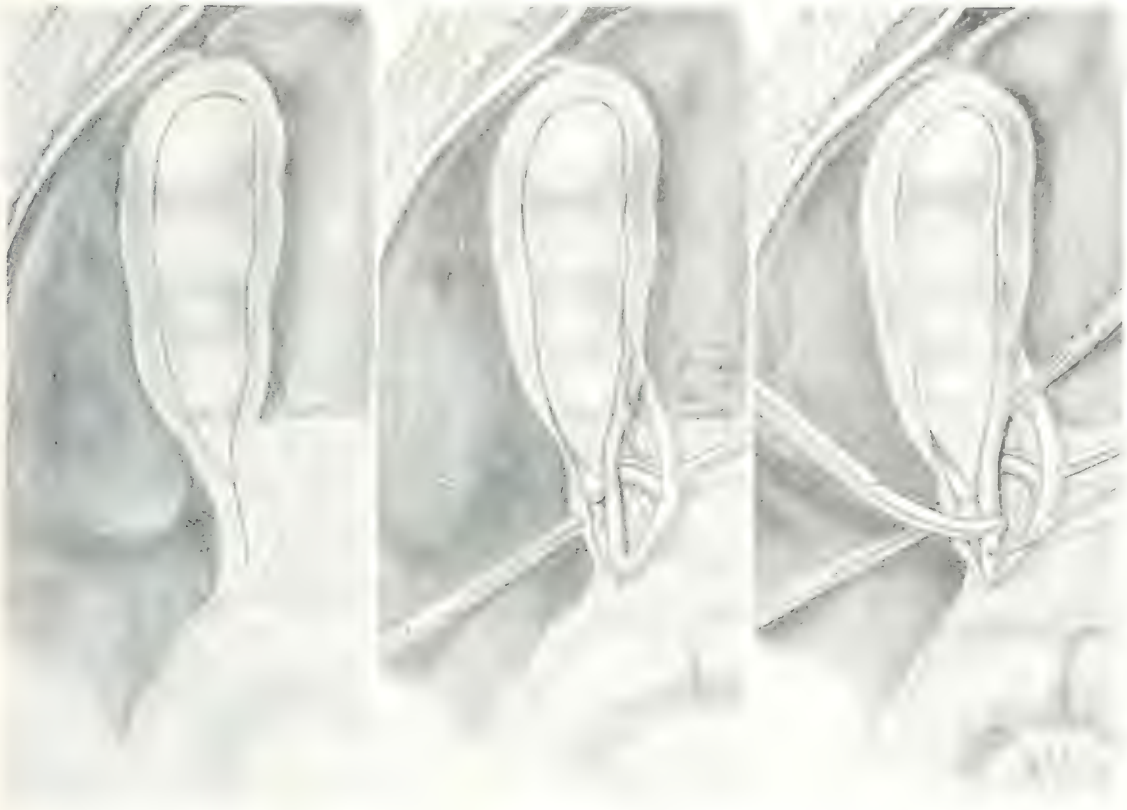

Fig. 2.

Fig. 4.

Fig. 2. Incision through peritoneum cov[illegible] bladder continued down through anterior leaf of [illegible] hepatic omentum.

Fig. 3. Cystic and right hepatic ducts defined. Cystic artery located.

Fig. 4. [illegible] from below. Cystic duct clamped [illegible]

be incised along the lateral aspects of the organ in such a manner as to leave a cuff on either side, the raw edges of which can subsequently be sutured together covering the raw surface left after the removal of the gall bladder (Fig. 2). By this technique the gall bladder is removed from its attachment to the liver along the original line of cleavage between the two structures and the surface of the liver is not torn. Consequently there is but little hæmorrhage from liver surface. Careful dissection of the biliary duct system in the gastrohepatic omentum obviates the danger of injury to the ducts, either of including the hepatic or common duct in the clamp and ligating them or partial division of the common or hepatic ducts. If the typical arrangement of the junction of cystic and hepatic ducts in which the hepatic duct joins the cystic duct at an acute angle forming the triangle of Calot were the rule, [illegible] Ruge states, however, that this arrangement obtains in only [illegible] have been substantiated by other observers. Seelig (1) has already pointed out the importance [illegible] and advocates removal of the gall bladder from above downward in order to minimize the danger of injuring the ducts. Eisendrath [illegible] has given a detailed study of the arrangement of the biliary ducts which fully confirms the observations of Ruge and the earlier observers. In the technique here described the cystic duct, being dissected out, is clearly defined and the danger of injury to the hepatic and common ducts is practically done away with. Before clamping [illegible] down to its junction with the hepatic duct and carefully examined for stones lodged in its distal

Fig. 5

Fig. 7.

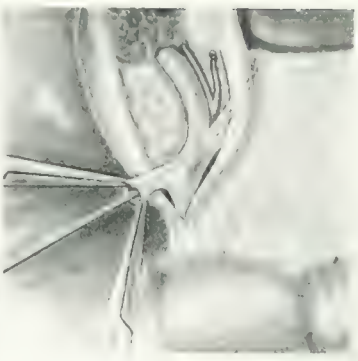

Fig. 8.

Fig. 5. Removal from below upward. The cystic duct is shown ligated but this is not done until after the ducts have been explored (see Figs. 7 and 8).
Fig. 7. Probing common duct (after Seelig).
Fig. 8. Probing hepatic duct (after Seelig).

portion. Owing to the slight constriction caused by the junction with the common hepatic duct stones in the duct are often arrested at this point. It is well to bear in mind that cases in which there is a history of biliary colic nearly always show calculi in the cystic duct. Calculi in the gall bladder itself do not cause colic and may and often do remain quiescent for years and give no symptoms. Therefore if biliary colic is a symptom it is fairly certain there will be calculi in the cystic duct. These may be very small, if of the mulberry variety, and extremely difficult to palpate. In a recent case it was not possible to palpate any calculi until the duct had been carefully isolated, when three small mulberry stones were found in the cystic duct, the largest of which was 3 millimeters in diameter and the smallest 2 millimeters. The distal stone being located, it is frequently possible by gentle manipulation to move it up a sufficient distance to apply the clamp below it as shown in Figure 4. After division of the cystic duct the gall bladder is removed from below upward (Fig. 5).

In removal from above downward (Fig. 6) it is well to make a preliminary examination of the ducts in the gastrohepatic omentum. In many instances complete dissection is impossible and it is in such cases that removal from above downward is indicated and the dissection of the ducts is completed after the gall bladder has been mobilized. The subsequent steps of the procedure are the same in either method of removal. By carefully dissecting the peritoneum from the mesial side of the gall bladder as the dissection proceeds downward from the fundus the cystic artery can be isolated, clamped, and divided with little, if any, hæmorrhage, and hæmorrhage more than anything else makes an accurate dissection of the ducts difficult.

After the removal of the gall bladder the remaining portion of the cystic duct, the common duct and the hepatic ducts must be carefully explored for stones (Figs. 7 and 8). This is done both by probing either with a probe or in the case of dilated ducts with the finger or by placing the finger in the foramen of Winslow to the right of the hepatic artery and palpating the common duct as it passes between pancreas and duodenum to its orifice in the latter. This is not a difficult procedure when the probe is in place in the duct. If stones are found they are removed either by direct or transduodenal choledochotomy.

The treatment of the stump of the cystic duct and whether or not to drain the site of operation

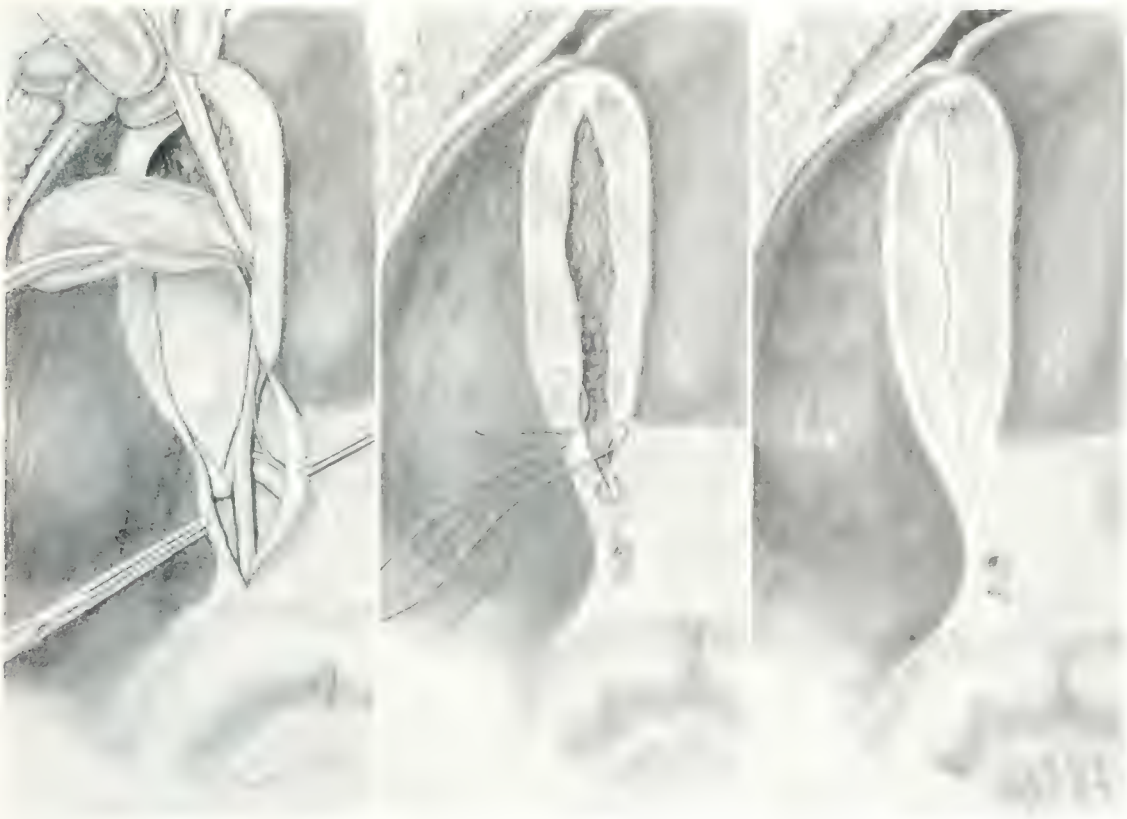

Fig. 6. Fig. 10.

Fig. 6. Removal from above downward. Cystic artery is being approached preliminary to ligation.

Fig. 9. The cystic duct has been ligated and sutured in the sutured incision in the gastrohepatic omentum in hepatic duct.

Fig. 10. Operation completed. Peritoneal cuffs sutured to cover raw surface of the liver.

is a difficult one to decide and the surgeon must make this decision at the time of the operation. Although no rule of thumb can be laid down it may be stated that the determining factor is the condition of the biliary ducts, hepatic, cystic and common. If there is present a condition of the ducts which will give rise to a mechanical blocking of the lumen, drainage is necessary until such a time as the patency of the lumen is re-established. The blockage is usually temporary and disappears in a comparatively short time. As a rule it is due to an inflammatory swelling or œdema of the lining epithelium caused either by infective cholangeitis or trauma incident to the presence of stones. The mechanical block due to stones themselves may be disregarded as all stones should be removed at operation. That due to injury of ducts may also be disregarded as with an operation performed as noted above the ducts are clearly exposed and anomalies recognized and dealt with accordingly. The trauma incident to the removal of stones from the hepatic or common ducts will practically always be followed by an œdema of the lining epithelium of the ducts sufficient to cause a temporary block to the passage of bile. It is, therefore, the practice of the writer, in all cases in which no stones are encountered in the common or hepatic ducts or in which there is no marked inflammation of the mucosa of the ducts, to close the cystic duct by ligature, cauterize the stump, and religate with a heavy catgut ligature placed just beyond the first ligature nearer the beginning of the common duct. The ends of this ligature are left long and their use will be described later. If there are stones present it may be assumed that the trauma incident to their removal is sufficient to cause an edema of the

mucosa which will give rise to a temporary mechanical obstacle to the passage of bile through the duct to the gut. In such cases both hepatic and common ducts should be drained. Drainage of the common duct through the stump of the cystic duct is sufficient in the presence of a cholangeitis not due to stones.

The question of the behavior of the short stump of the cystic duct when involved in the scar of healing seems an important one. If left free with the gastrohepatic omentum divided as in the usual operation, it may assume almost any position and cause an anomaly of its normal type of junction with the hepatic duct. Stetten (3) described an angulation of the junction of the hepatic and common ducts after cholecystostomy which gave rise to symptoms that could be relieved only by a secondary operation. It is a far different procedure to locate the stump of the cystic duct at a secondary operation after cholecystectomy than after cholecystostomy, for the gall bladder is no longer present to act as a guide in the dissection and in fact proper recognition of the exact relation of the ducts is well-nigh impossible. The cystic duct is immobilized by using the ends of the second ligating suture spoken of previously. After tying this the ends are threaded into needles and pulled upon until the duct stump assumes its proper relation to the hepatic duct. The needles are then passed through the edges of the incision in the gastrohepatic omentum and the stump of the duct anchored in place by tying the sutures (Fig. 9). That part of the stump beyond the ligature is free and uncovered so if any leakage takes place it will follow the line of least resistance to the abdominal wound along the line of the intraperitoneal drain. While if it disappears, as is usual in the process of healing, it leaves the stump of the cystic duct anchored in its normal position within the gastrohepatic omentum and adherent to the inner surface of the peritoneum of that omentum so that even though the gall bladder, which in the normal keeps it in place, is gone it still has a point of fixation and cannot assume an abnormal position and give rise to an anomaly of the duct relations or an angulation of the ducts. The gastrohepatic omentum being closed about and above it and the peritoneal cuffs from the gall bladder being sutured, a smooth peritonealized surface is left which reduces the danger of postoperative adhesions to a minimum (Fig. 10).

Though the ducts themselves are not drained it is erring on the side of safety to place a small cigarette drain down to the stump of the cystic duct which can be removed at the end of 24 to 36 hours. Should the stump of the duct break open the bile will flow along the tract thus formed and appear at the abdominal wound rather than escape into the peritoneal cavity. Thus far this has not occurred, but as a measure of safety I use the intraperitoneal drain and have not as yet had the courage to close the abdominal wall without this temporary drainage.

CONCLUSION

The functions of stomach, duodenum, and pancreas are very closely connected by the sympathetic nervous system. A break in this system made by an operation will cause a lack of co-ordination in the interaction of these various viscera which will give rise to disturbed digestion with resulting symptoms. This disturbance can be avoided by carefully performed intraperitoneal dissection of the biliary system with as little trauma and destruction of tissue as possible.

In order that after operation the bile may have a free passage from the liver to the intestine, it is important that the normal relation between the stump of the cystic duct and the hepatic ducts be maintained. This can be done by anchoring the stump of the cystic duct in the incision made in the anterior leaf of the gastrohepatic omentum.

Postoperative adhesions can be minimized by forming cuffs of the peritoneum covering the gall bladder and after removal of the gall bladder, suturing the cut edges of these cuffs.

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THE COMBINED TREATMENT OF FRACTURES OF THE SHAFT OF THE FEMUR

BY E. E. ELIASON, A.B., M.D., F.A.C.S., Philadelphia

IN 1918, the writer published an article[1] on the external fixation in fractures of the femoral shaft. Briefly, it is the fixation of the patient in a plaster casing with the limb in the flexed position. The casing is attached to a modified Bradford frame and the traction is likewise intact with the frame (Fig. 1).

Given a case of fracture of the shaft of the femur, what is the best means of handling it? The earliest possible application of traction is important. This should be applied with weights and fixation splints; Hodgen, Thomas (angled) or posterior angled splint. The traction must be in the line of the long axis of the broken bone and applied through adhesive or through direct bone attachment with the tongs, calipers, or pins.

The primary reduction under anæsthetic and the fixation in the flat position, gives poor results with shortening in practically every adult case; 100 per cent failures in a series of 88 cases recently reported. The flexed position without traction, in the same series, gave 25 per cent good results; operative treatment and dressings in the flat position without traction gave 33⅓ per cent good results.

With the limb fixed or under traction, sufficient to reduce the shortening, an X-ray is taken at the earliest possible moment. If the two views show good alignment and but little shortening, increase the traction, using tongs or pins, if the adhesive is not practical. Another X-ray is taken 24 hours later and if the fragments have the slightest amount of end-to-end approximation, the treatment is continued. It is absolutely imperative that the thigh and leg be flexed from 45 per cent to 60 per cent for it is only in this position that the muscles affecting the femur are in a state of "equilibrium."

In fractures of the upper half it is well to abduct the limb as well as internally rotate the lower fragment in order more nearly to meet the position of the upper fragment. At all times the strictest attention must be paid to the traction. It must work uniformly. A fish scales placed in the rope between the limb and the pulley will always indicate the efficiency and the amount of the traction (Fig. 1).

[1]Eliason. Method of external fixation for fracture of femur. Surg., Gynec. & Obst., 1918, xxvi, 1.

It has been the writer's experience that unless the fragments [illegible] an open reduction and fixation. Of course, in many instances good results are obtained, 56 per cent in the [illegible] operation, but it is rather a trying and hazardous method as it really requires especially trained nurses, orderlies, and assistants. (Figs. 16 and 21 illustrate results under such treatment.) If then, with the above treatment tried for 4 or 5 days, we cannot reduce the fracture or, obtaining reduction, we cannot maintain it, then it is our duty to advise operation, for in the above quoted series the closed treatment gave but 56 per cent good results. The success of the operative treatment depends, however, upon technique and postoperative care. In other words, we must prevent infection, make a stable union, without too much trauma, and finally maintain this internal splinting in a position of muscle equilibrium.

Preparation for operation. Most infections are of the staphylococcic type and probably are a result of skin contamination. To prevent this, use a scrub-up preparation the evening before operation and apply a sterile dry dressing. On the operating table (Hawley) use iodine and alcohol.

At this point the decision is to be made as to the type traction you will use for reduction and for postoperative treatment. If bone traction by the tongs or Steinmann nails is to be used, it should be placed now and attached to whatever is to be used as the tractor. The writer has devised an addition to the Hawley table which he has found very satisfactory. In the absence of this a stout loop of bandage can be passed through the tongs or Steinmann nuts and around the shoulders of an assistant or orderly. If the fracture is comminuted or other than transverse, one of these methods will be needed for reduction and maintaining it until the plate is applied. You cannot depend on manual traction as it cannot be maintained constant enough. If the fracture line is transverse or only moderately oblique neither of these may be necessary.

The best incision is the external anterolateral with its center laid at the level of the lower end of the upper fragment. The incision should be ample, i.e., from 6 to 10 inches long, depending

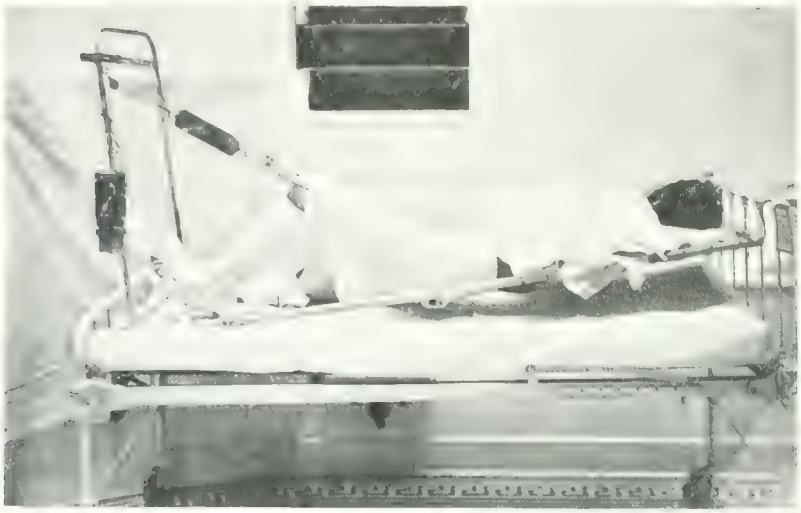

Fig. 1. Patient in fracture frame. Showing fish scales placed in rope between the limb and the pulley to indicate efficiency and amount of traction.

upon the case. Sew damp towels to the under surface of the skin edge. This is important in order that they may not be dislodged during subsequent manipulation.

Carry the incision down through the muscles, catching the bleeders as you go, until you open the hæmatoma at the fracture site. Remove the clots from the broken bone ends and the immediate vicinity. If traction will not reduce the shortening and the fracture is transverse or slightly oblique, grasp each fragment with a

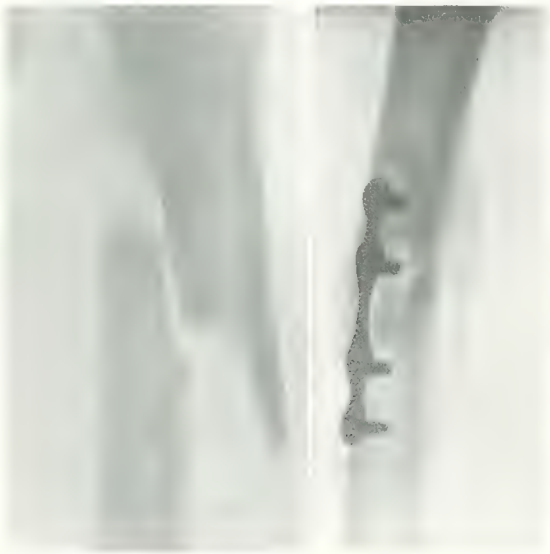

Fig. 2, a (at left). Case 1, after primary traction before operation. Unfortunately the roentgengrams which were taken later were lost during the moving of the X-ray department.

Fig. 2, b. Final result, Case 1.

Fig. 3 (at left). Case 2, five days after plating. Note the loosening of the screws. This case did not have postoperative traction.

Fig. 4. Case 2. Taken at time of follow-up report. Almost all of the angulation has been corrected.

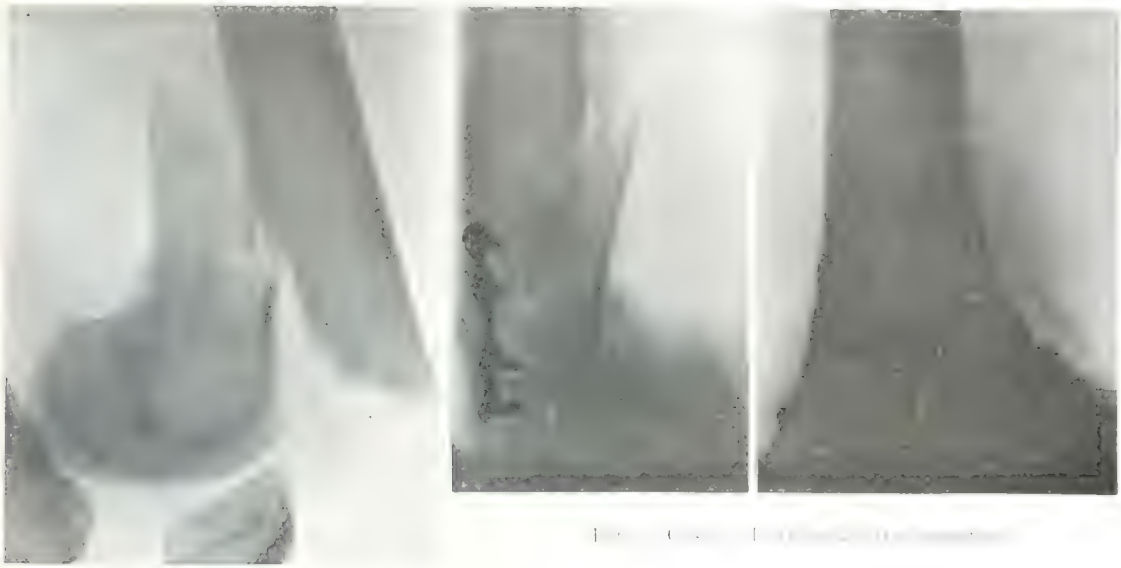

Fig. 5. Case 3. Before operation.

Lane forceps. Then have the assistant who has the leg in charge bend the limb away from the wound until the bone ends are angled out of the wound. After locking the ends one against the other, gradually straighten the limb, thereby reducing the fracture. This accomplishes reduction with the minimum amount of trauma, denudation of the bone and destruction of the blood supply. If it is found necessary to put a finger in the wounds, a fresh glove should be worn.

Fixing the fragments. Use a 4 to 6-hole Sherman plate and Sherman screws. From this point the limb should be maintained in the flexed position and one assistant delegated to be responsible that no undue strain is made on the plate and screws. Wire is not best except to encircle comminution. Bands can be used for long oblique and spiral fractures but I have seen some bad results from absorption of the bone ends and non-union. A fenestrated rubber tube, the size of a lead pencil, is placed in the dependent angle of the wound and reaching to the bone at a point an inch or two from the fracture site. The wound is now closed, skin included, with catgut. A heavy silk is passed through the exposed end of the drainage tube and the gauze dressings are split and applied, permitting the silk to come through all but the last layer, under which it is coiled and its position marked by a pill box top which will show its position through the plaster casing.

Maintaining this fixation is our next duty. The traction is now transferred to the bow which is attached to the frame which has been placed on the Hawley table previous to placing the patient upon it.

The patient is now enveloped in the plaster casing as described in the article noted above. From 12 to 20 pounds weight is added for the traction and this is kept on until the patient is out of the anæsthetic or better still for 24 hours. It is then gradually reduced in amount to 8 pounds as registered on the fish scales. The entrance and exit of the [illegible] are protected by [illegible] pin but not to the skin.

Forty-eight hours after operation a [illegible] window is cut over the pill box, it is lifted out, the gauze layer cut, the silk found and by this means the drainage tube removed. This little technical point obviates the necessity of cutting a large window over the wound, a procedure which all too often results disastrously. For how often have we seen the same leg loose and the fracture site angle into the fenestra, due to the absence of pressure, which should be afforded by the [illegible] dressings which will be seen to be stained with blood are now left alone as the catgut stitch will absorb.

I think this matter of drainage is very important as it allows exit to the postoperative [illegible] and permits the [illegible] natural place until the [illegible] of being healed [illegible]

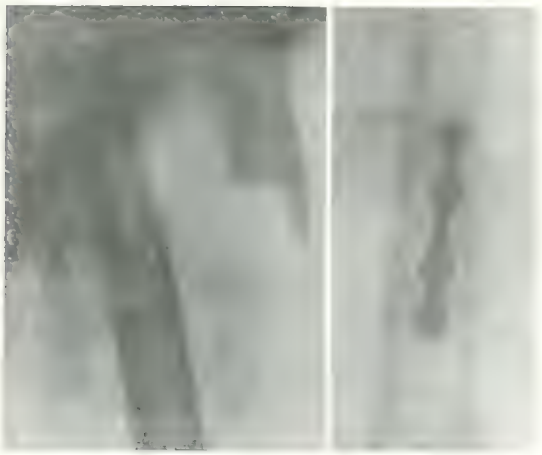

Fig. [illegible] Case 3. After three reductions, cast [illegible] Case 4. Lateral view.

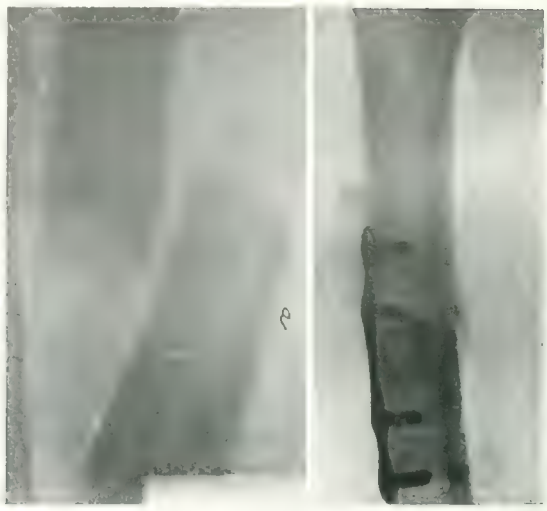

Fig. 9 (at left). Case 5. After two attempts at reduction, one under the fluoroscope.

Fig. 10. Case 5. Anteroposterior view.

of the 13 reported cases below, all of which were drained, was there either infection or non-union.

An X-ray, 2 views, is taken within the first few days. The patient being fixed on the transportable frame makes this possible without danger to the fracture. At the end of a week the plaster casing is cut away from in front of the leg thus leaving the leg and foot lying in a posterior molded splint. This permits daily motions of the ankle and knee which should be passive for the first 4 weeks. The muscle action is very essential to the blood supply. We have all noted how, in obtaining blood from a vein, the clasping of the fist augments the flow. The patient can attend to this with a bandage under the heel, then through a pulley and to his hand. Massage also should be given.

The position of the fragments must be checked up every 1 or 2 weeks by X-rays until union has occurred. The traction is maintained until union is firm and the flexed position is also maintained for from 5 to 7 weeks. This is of vast importance, for all too often have we seen plates and screws pulled loose and the original deformity return when these cases have been placed too soon in the flat position, without traction. Complete weight bearing should not be allowed for from 4 to 6 months in the adult.

The 13 cases reported below in detail, all, with one exception, were treated by the writer in the position of muscle equilibrium and with one exception with postoperative traction.

Case 1. J. D., age 11, admitted November 23, with history of being struck by an auto truck. On admission examination found a fracture of the right femur, laceration of the scalp and left thigh and cerebral concussion, mild in type. Dressing with traction and splints in the flat position did not result in reduction (Fig. 2, a). On November 24, open operation under ether and through an external anterolateral incision was done and a 4 hole Sherman plate was applied. A drainage tube with a silk pilot was used in the dependent angle of the wound. Adhesive traction of 10 pounds with the limb in the flexed position was used. A plaster cast was applied taking in the entire affected limb and pelvis and with a few turns made around the upper portion of the unbroken thigh after the manner of a pair of trousers with one short leg.

November 27, drain removed—wound clean.

December 18, skin grafting (Thiersch) on left thigh.

December 26, grafts all successful. On February 14, cast was removed and the limb rested on pillows, allowing the knee to straighten slowly. February 17, discharged, with union and no deformity. Advised to use crutches and report to surgical dispensary in 1 week (Fig. 2, b).

Follow-up report: Patient says he would not know his thigh had been broken.

Case 2. C. W., age 14, admitted September 30, having been struck by an auto. Examination found cerebral concussion, laceration of left eyebrow and fracture of the shaft of the right femur. A temporary Bucks traction and sandbags were applied to the broken limb until the patient's condition would warrant interference.

October 6, ether anæsthesia, reduction and posterior angled splint with traction. X-ray shows poor position.

October 16, open reduction was done through an external anterolateral incision using a 4 hole Sherman plate and a pilot drain. Limb was put up in the usual plaster trousers with one short leg on affected side but no traction was used as the fracture surfaces were so firmly dovetailed.

October 20, Figure 3, shows perfect alignment and end-to-end approximation. Due to a misunderstanding a 6-inch fenestra was cut in the plaster and the drain removed.

November 8, X-ray reports anterolateral bowling and a pulling loose of the two lower screws. This bowling was pushing into the fenestra.

November 10, cast removed and a posterior gutter splint with longitudinal and lateral traction applied.

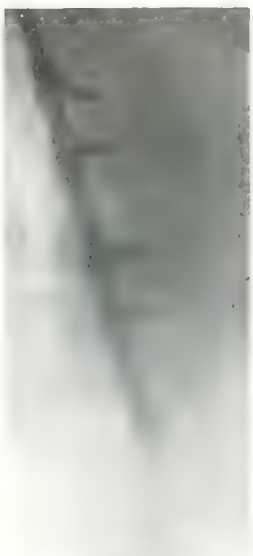

Fig. 11 (at left). Case [illegible]. After primary [illegible] hours.

Fig. 12. Case 6. Anterior view 3 weeks after operation. The light streak down the center is an artefact.

December 18, discharged. Union [illegible] ¼ inch shortening.

Follow-up report 2 months later: Patient walks with a very slight limp, has ¼ (?) inch shortening and the wound is open, superficially. Three months later the loosened plate was removed, when the wound promptly healed. The next follow-up report later, shows no disability, no demonstrable shortening, no limp and Figure 4 gives the X-ray.

The patient does have, however, relaxed ligaments in his knee, allowing a slight "back knee" due to the prolonged traction exerted through the knee joint, illustrating the disadvantage of such traction. The condition does not inconvenience the patient in the least according to his own statement.

Case 3. J. G., age 24, admitted to hospital November 13, with history of having fallen 15 feet into a hole, striking on his knee. Examination shows a much distorted limb. There is shortening and great deformity. The lower end of the upper fragment has penetrated the quadriceps tendon just above the patella and presents beneath the skin. Limb dressed flat with straight splints and traction. X-ray showed a supracondylar fracture in bad position.

November 14. Open reduction through an external anterolateral incision. Steinmann nail traction added. It was found that the knee joint was opened by the upper fragment and that some comminution was present. A 4 hole Sherman plate was applied, a pilot drain placed, and 20 pounds traction added. The usual plaster trouser cast was applied.

November 16, drain removed.

November 21, anterior half of leg cast removed and slight passive motion of knee and ankle.

December 1, because of [illegible] it was removed and a Hodgen splint applied with traction still acting.

December 14, Steinmann nail and traction removed.

A slight superficial infection was present around the entrance of the pin.

[illegible] the Bryant position.

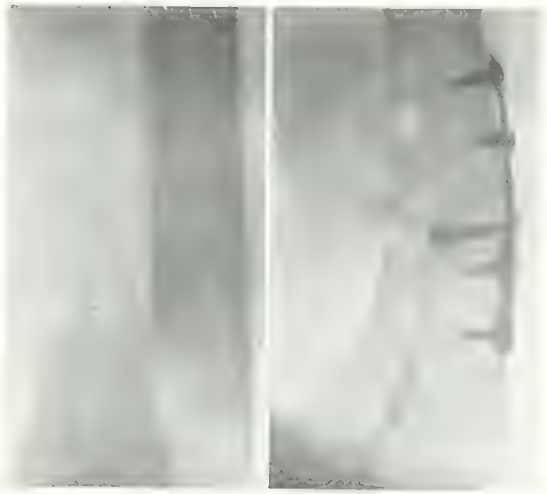

Fig. [illegible] (at left). Case [illegible]. After reduction and cast in fair position.

Fig. 18. Case 10. Lateral view 3 weeks after operation. The wire loop was used to fix the external condyle.

Fig. 19 (at left). Lateral view of Case 11, 15 weeks after fracture.

Fig. 20. Case 11. One month after operation.

Follow up report: Patient says his leg is perfect. He has no lump, pain or limitation of motion. Lost time was 6 months.

Case 4. I. C., age 15, admitted November 5, with a fracture of the middle of right femur. X-ray at once showed the usual deformity and overlapping.

November 6, ether and reduction and plaster cast showed no improvement (Fig. 7).

November 20, open reduction was done through external anterolateral incision, the fragments angled into position and a 4 hole Sherman plate put in and a pilot drain added Fig. 8). Patient fixed in a flexed position in the trouser plaster cast on the modified frame, with traction, being applied by adhesive.

November 9, drain removed.

December 9, top of leg cast removed and it was found that the patient had a peroneal palsy. He was given a sling and pulley attachment for exercise.

December 20, cast removed and 5 days later the patient was discharged with solid union, no deformity, and walking on crutches.

Follow-up report: Patient has no deformity, shortening or joint limitation. He says his leg is perfect.

Case 5. A. C., admitted May 24, with history of being hit by an auto. Left femur was found broken at the middle portion. Patient was given anæsthetic at once and reduction attempted. Fourteen pounds pull overcame the shortening, but crepitus could not be obtained. X-ray showed posterior position and shortening (Fig. 9).

May 26, Bryant treatment applied with 18 pounds traction.

May 30, X-ray reports the same deformity (Fig. 9). Attempted reduction under the fluoroscope disclosed the fact that something kept the ends from engaging.

June 1, open reduction was done through the usual e-a-l incision. A fibrous band attached to the linea aspera prevented reduction. A 4 hole Sherman plate was applied and a pilot drain put in place. Patient was put in the flexed position with plaster trousers and fixed in the modified frame. Adhesive traction with 10 pounds was added.

June 12, X ray reports good position.

July 4, cast was removed and the X-ray showed good position and union (Fig. 10).

July 13, patient discharged with solid union—no deformity and no shortening.

Follow-up report: Patient, 4 years after operation, walks without limp and states that his limb is as good as the other one.

Case 6. H. A., age 34, admitted October 23, following an auto accident. Examination revealed a crescent-shaped laceration through the cheek, fracture of 2 ribs, 2 metacarpals, 5 phalanges and the right femur. The femur was dressed on a moderately angled double inclined plane with traction. An X-ray the following day showed a comminuted fracture (Fig. 10). Patient was dressed on a Hodgen splint and adhesive traction with no better results, despite 46 pounds of traction.

October 24, open reduction, e-a-l incision and with the aid of the Steinmann nail traction, a 6 hole Sherman plate and a wire for the comminution was used. Pilot drain placed in the wound. The usual plaster trouser and frame dressing with 20 pounds traction applied. Traction reduced to 12 pounds at end of 3 weeks. Cast cut out over the leg and a peroneal palsy found, which was, I think, due to a cinch traction that we used to pull with. Passive motion, massage, and electricity. X-ray shows good position (Fig. 12).

December 30, Steinmann pin out. A slight infection was found at the entrance of wound.

January 15, cast removed and 2 weeks later patient was allowed upon crutches, having solid union and no deformity. The peroneal palsy had disappeared.

Follow-up report: Patient states, 18 months after operation, that his limb is as good as the other. There is no deformity or limp. Time lost, 16 weeks.

Case 7. M. G., age 46, admitted November 24, with a comminuted fracture of the middle of the shaft of left femur. After attempt at non-operative treatment with adhesive traction with poor result, open reduction was

Fig. 21. Case 12. Two months later than in Figure 20, showing solid union.

performed November 27; e-a-l incision, 6 hole plate, pilot drain, Steinmann traction, and a plaster trouser and frame dressing. Traction 12 pounds.

December 10, cast cut and knee and ankle motion started. Wound clean.

December 20, Steinmann nail out.

January 8, cast removed and solid union found with no deformity. Fig. 13.

January 5, discharged in good condition on crutches.

Follow-up report: Patient states, 1 year after operation, that she has a good leg and no limp, but occasionally has rheumatism, which, however, she had before her accident.

Case 8. E. Z., age 52, admitted March 27, with a subtrochanteric fracture of the left femur. The X-ray showed a very unique transverse fracture, with marked abduction of the upper fragment, evidently an operative case. Dr. E. Martin, assisted by the writer, performed open reduction, March 29, using 4 screws, Sherman plate and a pilot drain (Fig. 14). Steinmann nail traction, and 10 pounds. The plaster trouser dressing and the frame were used, with limb in the flexed position.

April 4, drain out, wound clean.

April 20, cast cut away and [illegible] started.

May 13, traction removed, pin [illegible]

June 18, patient discharged [illegible] union and no deformity. Fig. 14. [illegible] ¾ inch shortening.

Follow-up report: Patient reports that she has no trouble with her leg except occasional damp weather pains.

[illegible] having [illegible] shaft of femur.

November 20. X-ray shows the usual deformity with overlapping.

[illegible] 15½ pounds, with adhesive dressing (Fig. 1[illegible]

December 27. Steinmann pin and flexed position and [illegible]

[illegible]

[illegible] titis.

March 25, discharged on crutches with solid union, but with a flexed knee.

[illegible] shortening and no deformity (Fig. [illegible] complaint. Joint motion is normal.

Case 10. H. F., age 56, admitted to hospital with a [illegible] weeks after the accident, open reduction was done. The [illegible] local condition a bone traction was not used. The plaster trouser cast was applied.

[illegible]

[illegible] begun.

January 19, cast removed, union solid, a slight [illegible]

[illegible]

March 20, patient walking with help of crutches using the limb as a partial weight bearer, and improving rapidly at this time of writing.

November 11, patient walking unaided. Joint action [illegible]

Case 11. C. Y., age 16. When patient first came to [illegible] attention, she gave the history of having had [illegible] femur and the upper end of her tibula broken in an auto accident 15 weeks previously. On examination, September 21, [illegible] it was found that she had 2 inches shortening, a very pronounced angulation deformity and fibrous union. The X-ray, Fig. 19, showed angular overlapping. On September 27 an open reduction was performed. Through the e-a-l incision the ends of the bone were freed and angled out of the wound. The ends were sawed transversely, sacrificing between ½ and ¾ inch bone. Engaging one extremity against the other the limb was slowly straightened, consuming about 10 minutes for the completion. Consequently the patient was not shocked, as always happens in old shortened cases if traction is done hurriedly. A 4 hole Sherman plate was inserted also a pilot drain. Plaster trouser cast and traction on the frame was employed.

September 30, drain removed, wound found clean.

October 15, the cast was cut out and motion of the knee and ankle started. X-ray taken October 20 shows the fragments in good position (Fig. 20).

November 20, cast removed. Two weeks later the patient was around on crutches using the limb as a partial weight bearer. Union was solid.

Follow-up report: Her physician writes me 6 months after the operation that she has a good limb, with a scant ½ inch shortening and walks without a limp.

Case 12. M. L., age 18, admitted January 2, having fallen down a ship's hold and fractured his right femur and left tibia, and fibula. X-ray shows a comminution through and below the trochanters, as well as the shaft fracture. The patient was an underfed, emaciated, anæmic boy, and it was not deemed wise to do an open reduction. The limb was put up in a Hodgen splint and the Steinmann nail traction used. Knee and ankle motion started in 3 weeks. Figure 21 shows the result after 2 months in bed.

April 23, patient was discharged with no deformity and solid union with ¾ per cent knee motion. This case is not really one of the series. It is merely used as illustrating bone traction. Follow-up report unobtainable.

Case 13. W. N., age 54. Compound fracture of the middle of the femur. Dressed temporarily with adhesive traction and suspended Thomas splint for X-ray.

August 23, patient removed the traction. X-ray showed overlapping and lateral displacement of the lower fragment (Fig. 22). Operation was performed through the e-a-l incision. The fragments were angled until they dovetailed into perfect approximation, so perfect that it became a question as to whether to plate or not. Experience with such cases indicated a plate, and in this case using a 6 hole plate, not having a 4 hole one boiled up. Drainage and the trouser plaster cast with Edmonston long traction carrying 25 pounds.

August 14, weight reduced to 20 pounds.

August 15, drain removed.

August 20, wound clean.

September 1, foot and ankle freed for movement.

September 12, cast and tongs removed, suspended in Thomas splint and X-rayed (Fig. 23).

October 7, union firm—no shortening, crutches.

October 23, perfect foot and ankle motion, flexion at knee still 50 per cent reduced. X-ray photographs comparable to those taken 5 weeks before, except showing more callus.

December 19, follow-up report: Patient says his limb is fine. He walks without limp, has no demonstrable shortening or other deformity. Ankle motion normal; knee has complete extension and about 70 per cent flexion.

I think Figure 23 shows most conclusively that postoperative traction is absolutely essential. This plate was broken while applying the cast; suspected because of an audible snap. The X-ray was not taken sooner because of mechanical difficulties. The fact that the fragments slipped from the true dovetailed position into a false one proves that the displacement occurred before callus or fibrous tissue deposit, which would permit of angulation rather than a distinct lateral displacement. This bears out the experience in other cases, namely a loosened plate results from the screws pulling out 10 days to 2 weeks after operation, broken plates occur at time of operation. Despite the broken plate before any union had occurred, traction maintained axial alignment perfectly.

The above series is not a selected one, but is composed of those cases, 11 in number, in hospital and private work, in which what we might term the combined treatment was used, namely internal and external fixation with same type splint (plaster in this series), and the continued employment of traction. It is poor surgery to plate or wire a fracture and then not give it the benefit also of the proper state of muscle equilibrium which is only accomplished by fixation, position, and traction.

If, however, circumstances do not permit open operation, the next best treatment is suspension and direct bone traction, of which Cases 9 and 12 are examples. In both of these cases the direct bone traction had to be used as the adhesive proved inadequate.

SUMMARY

1. In the 11 operative cases all were drained and no infections occurred.

2. No case had a bad result; the greatest shortening was one-fourth inch.

3. But one plate had to be removed and that was due to 2 errors, i.e., too large a fenestration and no traction.

4. The follow-up reports after months, and in a few cases, years, show no changes for the worse and no plates have had to be removed.

5. Every one of the 13 patients had a first-class limb, with no limps and joint limitation, but slight in 2 cases.

CONCLUSION

Judging by this small series, the best treatment for fracture of the shaft of the femur is the continued use of internal and external fixation in the full sense of the word. It gave 100 per cent good results.

EDITORIALS

SURGERY, GYNECOLOGY AND OBSTETRICS

FRANKLIN H. MARTIN, M.D — Managing Editor
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OCTOBER, 1922

RADIUM TREATMENT OF UTERINE FIBROIDS

EXPERIENCE has established the fact that radium is the best known remedy for selected cases of uterine fibroids. Uncomplicated symmetrically developed fibroids, not larger than a uterus of three or four months' pregnancy in women near the menopause, are successfully treated with radium. One thousand two hundred to one thousand eight hundred millicuries (milligram hours) of radium element, thickly screened, is advised. One thousand eight hundred usually produce no more symptoms than one thousand two hundred millicuries, and are almost certain to produce a permanent menopause, except in younger women. Re-establishment of menstruation, in our experience, has resulted in renewal of growth and recurrence of symptoms.

The radium should be placed within the cavity of the body of the uterus. One and occasionally two menstruations may follow the treatment before amenorrhœa results. Atrophy of the tumor commences about the eighth week. In four or five months the tumor may be felt as a small nodule, but has usually disappeared, or has become so small that it cannot be palpated.

Intramural fibroids are best suited for radium treatment but subperitoneal and even submucous do not necessarily contraindicate its use.

Intra-abdominal complications especially chronic infections indicate surgical treatment. When cases which are complicated with chronic pelvic infection are treated with radium, there may result reinfection and abscess formation.

The objection to the use of radium in larger tumors is chiefly the danger of mistakes in diagnosis. When radium is used the diagnosis should be frankly certain; the fibroid uterus should be one that can be freely rolled between the fingers on conjoined palpation.

Success in radium treatment necessitates production of a permanent menopause. This fact is the principal reason for use of the thick screen. The thick screen does not materially increase the amount of radium required to stop ovulation, but lessens materially the amount of necrosis at the site of radiation and thus lessens the dangers of infection and the amount of the thin watery discharge that results.

In younger women it is preferable to remove the fibroid growth by means of surgery rather than to destroy the function of the ovaries by radium.

The limitations to the use of radium may be extended in cases of poor surgical risk.

The nervous disturbances associated with the menopause following radium, in our experience, have been about the same as those after the natural menopause.

THOMAS J. W[illegible]

INTRA ABDOMINAL AND INTRA VISCERAL PRESSURE

SURGEONS are prone to take a materialistic, mechanical, "two times two is four" view of things, often to the exclusion of important principles. Every surgeon, in operating upon asthenic patients with general abdominal ptosis, has observed the dilated and atonic condition of the stomach, bowels, ducts and even blood vessels. Without serious thought, he has often acceded to the neurological view that the case represents some obscure form of neurological or nutritional dyscrasia.

The well-known and efficient Weir-Mitchell rest cure and forced-feeding treatment for neurasthenics was based on the presumption that rest plus padding of the irritable nerves with fat brought about the good results. In the Muetter lecture for 1913, I showed a number of roentgenograms illustrating the difference in size, motility, and position of the hollow viscera before and after fattening, which were very striking. In many instances of patients with dilated, atonic, dropped stomachs, who had been fattened, the stomach had been lifted to its normal position, normal peristaltic waves had been restored and the size of the stomach had been reduced by half. My theory as to the cause of this change was that the deposit of fat in the abdominal cavity enclosed by relatively inelastic walls had greatly increased intra-abdominal pressure and at the same time had thickened and shortened the mesenteries. Nine additional years of intensive study of a much larger number of cases has firmly developed this assumption into a conviction.

Up to 1909, more than two hundred and fifty articles had been written of experimental work on implantation of the ureter into the bowel. No successful series had been reported. All methods had failed because of so-called "ascending infection." All attempts had been along purely technical lines. During 1909, in the course of experimental work on the pancreas, I discovered that bile ducts transplanted into the intestine by direct methods always dilated. Dissection of the duct of a normal dog's duodenum showed that it traversed the space between the mucous membrane and muscle for some distance before entering the bowel. I assumed that intra-intestinal pressure, exercised on the mucous membrane overlying the duct, normally closed it against direct entrance of intra-intestinal pressure into the duct. This was proven by transplanting ducts to a similar position under the mucous membrane by operation, when it was found that no dilatation took place. Similar experiments proved that the ureter could be successfully implanted in the same way. The kidneys, ureters, and intestines of five dogs with healthy kidneys and undilated ureters, following operations from 2 to 6 months, were presented before the American Medical Association in 1910. C. H. Mayo has now implanted more than a hundred ureters clinically by the submucous method with remarkable results. Smaller series of equally successful cases have been reported by Lower, Hunner, myself and others. We believe these results can be explained by static intra-intestinal pressure brought to bear on the mucous membrane overlying the duct.

The circulating fluids of the body are propelled through elastic tubes by intermittent muscular contraction acting as the *vis a tergo*. In order to maintain the ground gained during intervals of contraction, mechanical valves have been used; for example, the valves of the heart, the veins, ureters, bile duct and the ileocæcal valve. By the use of these valves, combined with muscular action, fluids may be delivered from a cavity of a lower to one of higher intravisceral pressure. For example,

the ileum, with a relatively lower intra-intestinal pressure, may permanently deliver fluid into a distended large intestine of much higher intra-intestinal pressure, if the ileocæcal valve is perfect. Bile under low pressure may be delivered from a relatively non-muscular bile duct into the duodenum of much higher pressure under certain circumstances provided the mucous valve protecting the end of the duct is good.

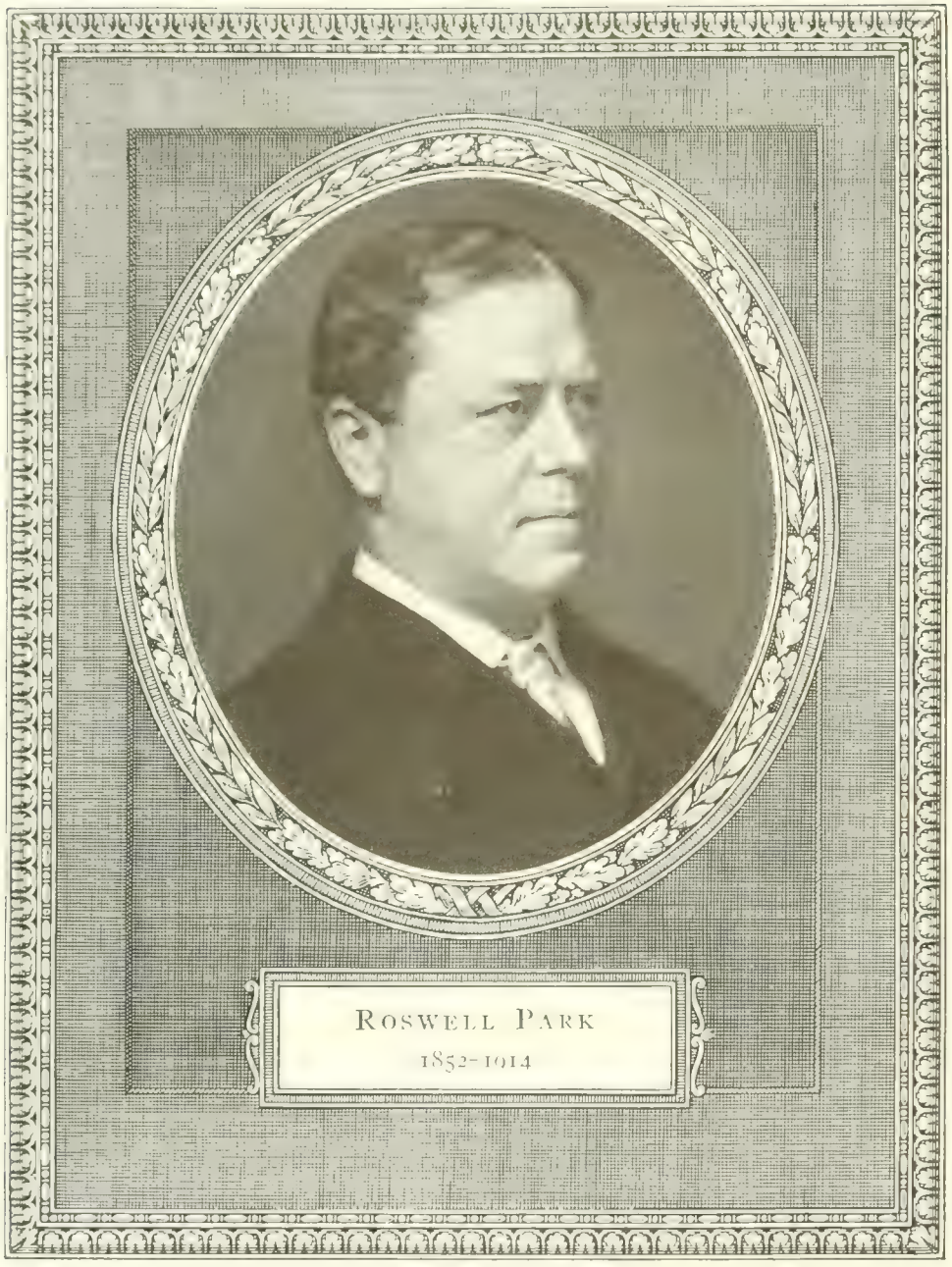
Every surgeon has noted that a biliary fistula ceases to discharge during the day some time before it ceases at night. Kehr, noting this, fed his patients frequently during the night and found, when he did so, that the flow of bile was the same night and day. Terry feeds his patients frequently night and day following cholecystectomy, to prevent the dilatation of the common duct.

Every surgeon has noted that when the gall bladder is removed or becomes functionless, the common and hepatic ducts dilate. Judd and others believe that the sphincter of Oddi is entirely responsible for this. While conceding the importance of this muscle, I do not believe it is entirely responsible or even the chief agent. Dilatation takes place when the duct is planted directly into the intestine without the sphincter of Oddi. It is probable that if the peristaltic waves of the duodenum could be maintained during most of the 24 hours, dilatation would not take place.

The question may be asked, how does an implanted ureter or bile duct containing fluid under low pressure permanently deliver its fluid into the intestine of much higher pressure, and particularly if there is no great amount of muscular tissue in the former? How does an undistended small intestine permanently deliver fluids and gas under relatively low pressure into an obstructed large bowel in which the cæcum is distended almost to the point of devitalization? Such a thing, of course, can only take place in the presence of a perfect valve. The only possible explanation for this is that a peristaltic wave passing beyond the valve reduces the intra-intestinal pressure immediately in its wake. This permits of delivery of the fluid from a low pressure organ for the time being. The valve holds it until another peristaltic wave makes another relaxation and thereby makes the delivery permanent.

For practical purposes, it may be stated that the ileocæcal valve is formed by an intussusception of the end of the ileum through a hole in the side of the cæcum plus excessive development of a flap of mucous membrane at its end. This intussusception is normally fixed, and the valve should be competent. The valve is for the purpose of protecting the small intestine against the greater gas pressure formed by the bacterial digestion of the large intestine. In some cases of asthenia with marked constipation and gas dilatation of the cæcum combined with reverse peristalsis, the intussusception is reduced and the valve destroyed, with the result that the fetid gas of the large intestine pushes back into the small intestine and in some instances reverse peristalsis of the small intestine seems to be established. In such cases an opaque enema travels upward even to the upper portion of the jejunum. Such patients often have a great deal of distress in the abdomen with marked evidences of general toxæmia. Lane's ileosigmoidostomy for intestinal stasis produces this same result by the absence of the valve, in that the greater intra-intestinal pressure of the large bowel gradually distends the ileum, no matter whether the distal ileum is excluded or not. The operation is unsatisfactory. Toxic symptoms are only temporarily relieved. An additional colectomy produces better functional results but is very dangerous and not desirable. Medical management is successful in most cases. In some instances, however,

it is necessary to shorten the supports of the ascending colon and suspend the transverse colon by omentum in order to bring the organs in proper position for food functioning. The medical treatment consists of increasing intra-abdominal pressure by fattening and appropriate exercises for strengthening the abdominal wall, increasing peristalsis and bowel action by paraffin, agar agar, and bulky foods. Increased intra-abdominal pressure brought about by deposition of intra-abdominal fat, counteracts the intravisceral gas pressure, allows the muscle fibers to shorten and thicken, after which normal peristalsis is more easily established. In an individual with normal intra-intestinal pressure, normal intra-abdominal pressure, normal gastro-intestinal motility and bowel action, the ileocæcal valve is not so essential and ileosigmoidostomy is not followed by abnormal dilatation of the ileum or troublesome reverse peristalsis into the dead end of the cæcum as is seen in so-called stasis cases. In rare instances, it is necessary to restore the valve by reproducing the intussusception. Kellogg's method is very successful in some cases. R. C. Coffey.



ROSWELL PARK

1852–1914

MASTER SURGEONS OF AMERICA

ROSWELL PARK

DR. PARK was born in Pomfret, Connecticut, in 1852. His father was a man of note, having degree of Master of Arts from Union and Hamilton College, and Doctor of Divinity from Norwich University. Later he was the founder of Racine College in Wisconsin. Dr. Park's early years were spent in New England. He received his college degree in Racine College and his M.D. from Northwestern University. He was house surgeon in Cook County Hospital, Chicago. After filling various teaching positions in Chicago, he went to Europe for post-graduate study.

This European trip had a very remarkable effect on his later life. It was just at the time medical Europe was greatly excited because of the work of Pasteur, Lister, and finally Koch. He entered Koch's laboratory and there secured the foundation of his *Muetter Lectures* in Philadelphia, which later played such an important rôle in spreading surgical pathology in America. When he returned to America, he was an exceedingly well-trained man, and well fitted for his future career. The professorship of surgery in the University of Buffalo had just become vacant, and by the most fortunate circumstances for Buffalo, he was invited to the chair and accepted in the year 1883. He was destined to add further luster to that long list of such eminent men connected with the University of Buffalo, as Austin Flink, Frank Hamilton, John G. Dalton, James P. White, Hadley, Whithaus, and Edward M. Moore.

At this time surgery was in a sorrowful condition. Infections were the usual result of any interference. Modern surgical pathology was almost unknown. Upon this dismal surgical scene in Buffalo appeared Roswell Park, young and vigorous, handsome, a good mixer, musical, and exceedingly well trained in his profession. There was no possible escape from the brilliant career which awaited him.

Dr. Park was a prolific writer. His textbook by American authors largely written by himself was a two-volume work of which two editions were published. His *Modern Surgery*, a single volume containing over eleven hundred pages, published in 1907, stands today one of the most complete one-volume works in surgery. An epitome of the history of Medicine and the Evil Eye were among his book publications. From the year 1882 until his death about one hundred

and fifty papers were written on timely subjects. In 1882 he wrote one of the very first papers in this country on antisepsis. In 1884 and 1885 he wrote a series of papers on tuberculosis, giving accurately present-day description on bone tuberculosis. He was one of those who early insisted that pathological process in tuberculosis of bone and tuberculosis of lungs was one and the same. In 1888 he wrote a monograph on surgery of the brain which was one of our earliest publications on the subject

Dr. Park was not gifted in research, but read widely and developed a wonderful faculty of early recognizing the importance of new subjects. His very early papers on antisepsis, tuberculosis, X-ray, and radium are wonderful examples.

As a teacher his fame was well deserved. No one attended his Clinic but went away impressed. He was very particular about correct English in his written and spoken word. His delivery was free and pleasant. He never failed to be entertaining by introducing a suitable story. His wide knowledge of the allied sciences served him well because of his ability to use that knowledge in illustrating strictly surgical subjects.

In the operative theater he was always a master. He had wonderful poise in the presence of difficulties. His technique was excellent, at a time when that was the unusual thing. He had excellent surgical judgment.

He worked untiringly for Buffalo institutions; the Buffalo General Hospital was almost his home. He devoted the best he had to make it one of the finest institutions of the kind in this country. The University of Buffalo was ever on his mind. Through many long weary years he struggled for a greater University in Buffalo. One of the sad things was he did not live to see the fulfillment of his efforts. Six years after his death twenty-four thousand citizens of Buffalo contributed over five million dollars—in ten days time—to establish that University for which he had worked so consistently.

In reviewing the work of such a man, sufficient time has not elapsed to give one the proper perspective. His chief work will probably lie in promulgating the knowledge of—first, antisepsis, and second, the general principles of surgical pathology. Both of these subjects were fairly well understood in Europe, but in those days America was not only a poor copier but a late one. His lectures on surgical pathology, usually spoken of as the "Muetter Lectures," did more to place the correct pathology of surgical disease before the American profession than any other publication with which I am familiar. His early publications on surgical tuberculosis, more particularly that of bone, was far in advance of most other writings in America. Years later the profession was arguing whether these bone lesions were really the same process as occurred in the lung. In 1886 he did the first deliberate trephining in America where accurate localization was previously outlined. It was a case of cyst, following hæmorrhage and was operated in the Buffalo General Hospital.

Probably one of his greatest contributions to medicine will be found in his activity in founding the Gratwick Laboratory. He was the first man to realize and put into practice the advantages of a thorough investigation of the problems relating to cancer. Through his efforts, and those of his friends, he was able to establish a small laboratory in this college for that purpose. The beautifully equipped laboratory and the handsome hospital, known as the New York State Institute for the Study of Malignant Disease, at 113 High Street, is the end result. While others have since been more active in this work than he, yet I believe the credit of starting it belongs to Dr. Park.

Most men have fads and hobbies which steal their time, but he had few if any, unless music might be so considered. He played the piano a little quite well. He, with many others, gave freely of his time and money to start the first good concerts given in this city. He was president of the Philharmonic Society, and under his régime the now famous May Festival was inaugurated. These were self-sacrificing undertakings, because almost invariably they were a financial loss. It was worth it, however, because I never knew any one to get such keen enjoyment out of a good concert as he, and in later years, when most things failed in interest, his idol—music—still held him steadfast.

During his entire career, he had a certain pride in buying books, and often this trait made him the victim of the over-zealous bookseller. In the end, he developed a very highly prized library, probably the equal of any private library in this section of the country. In it are many very rare books, besides a really wonderful collection of surgical reference works, for instance complete sets of *Annals of Surgery* and *Zeitschrift fuer Chirurgie*, *Centralblatt fuer Chirurgie*, *Archive fuer klinische Chirurgie* and *Index Catalogue of Surgeon General's Library*. This library is now, by his will, the property of the University of Buffalo.

If we measure success by honors, the fates were exceedingly kind to him. At some time during his life he was president of the Academy of Medicine, American Association for Advancement of Science, State Society, American Surgical Association, Society of Natural Sciences, the Buffalo, Saturn, University and Liberal Clubs. He was a member of the German, Italian, and French Surgical Societies. He was the American representative on the international committee of the International Society, from its inception up to the time of his death. He was appointed by Theodore Roosevelt a member of the visiting committee at West Point Military Academy. He received an honorary degree of M.D. from Lake Forest University, A.M. from Harvard University, and LL.D. from Yale. In 1890 he was called to the chair of Surgery in Rush Medical College, but decided to continue in Buffalo. In 1908, on the twenty-fifth anniversary of his professorship of surgery in the University of Buffalo, the profession made him the guest of honor at a dinner, which was a most remarkable gathering of about one hundred and fifty persons, including surgeons of note from the United States and Canada,

He was given a beautiful loving cup, and later a handsome volume was edited as a memorial of the dinner.

His personality was remarkable, and his self-control under trying circumstances was the wonder of all who knew him. His courtesy to all was never failing. He was a good friend, admired by all, loved by many, and hated by none. His personal influence upon the young men of the community was not to be measured lightly, and his standard of honor wielded a power for good, far beyond the privilege of most men. While his surgical influence was the greatest possible, I firmly believe his greater good lay in his ability to train those around him, to be real, honorable, upright gentlemen. His influence in this particular will live on and on, and will ever hold memory dear, far beyond the mere passing of a great man.

EDGAR R. MCGUIRE.

CORRESPONDENCE

AMPUTATION STUMPS AND THEIR ADAPTATION TO ARTIFICIAL LIMBS

To the Editor: The article with the above title in the April, 1922, issue of SURGERY, GYNECOLOGY AND OBSTETRICS by Dr. Carl Bearse gives us, I believe, most of the important points that we gained from our experience with amputations during the war. It affords me much pleasure to support practically all of his arguments. There are one or two points, however, in regard to which I [illegible] somewhat different conclusion. Also I wish to emphasize much more than he does the importance of the early use of the temporary leg or pylon, and [illegible] this temporary leg may be [illegible]

First of all I believe we should object to amputating through the knee joint. In the past such

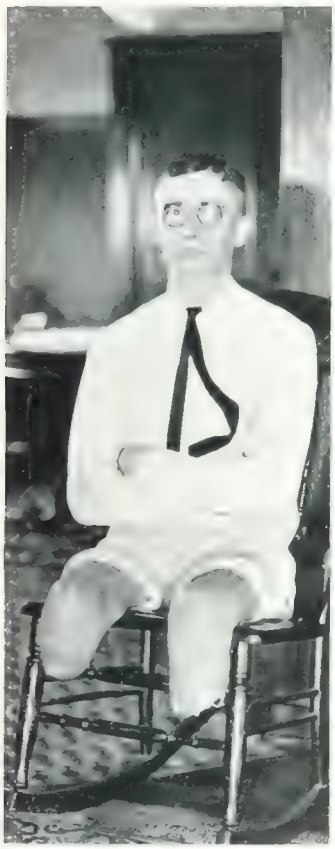


Fig. 1.

Fig.

Fig.

Fig. 4.

Fig. 1. Mr. M. Double leg amputation, December, 1921, because of severe deformity and chronic ulceration of both feet. Age 36. Occupation, sailor. Left leg stump not quite healed at end of 6 weeks.

Figs. 2 and 3. Plaster bucket pylon, put on right leg February, and left March. Began walking on right py- [illegible] weeks.

[illegible] Patient able to [illegible] largely as a result of his preceding 6 weeks on temporary [illegible]

cases I saw the stump was always unsatisfactory, and the application of any leg extremely difficult.

Another point with reference to the selection of the site for amputation is that arm stumps and above knee stumps should in general be as long as possible. Even when it is necessary to depend upon skin traction to cover the end of the bone, as much bone should be saved in these stumps as can be. So much of the usefulness of artificial limbs in these cases depends upon additional leverage, that even an extra inch or so should be saved if possible. This point should always be borne in mind. In the after-treatment of all amputation cases, this point of traction on the skin should be remembered. This is especially true if there is any difficulty about covering the end of the bone, or in the matter of securing good healing of the skin edges. Skin traction by means of the modified Thomas splint, or in some other way as described by various writers, will often serve to cover these stumps, even when the bone on first observation seems too long. Even in the case of infection and sloughing, primary or secondary shortening of bone should not be done until a thorough attempt to lengthen the soft parts of the stump by traction has been made.

With regard to the use of the plaster-of-Paris bucket temporary leg or pylon, this is something regarding which I learned a good deal during my association with Sir John Lynn Thomas, of Cardiff, who was chief surgeon to the Prince of Wales Hospital for Limbless Men, and Major Alwyn Smith, who was in charge of the Orthopedic Center at the Welsh Metropolitan War Hospital. In our work at Savenay also, where Major Phillip D. Wilson was in charge of the amputation cases, hundreds of these pylons were put on.

These temporary pylons, as illustrated in Figures 2 and 3, can be put on within 2 or 3 weeks of the time of amputation. They enable the patient to walk practically at once, and what is more important, prepare the stump, both by exercise and pressure, for the wearing of the regulation leg a little later. In amputations close to the knee, such a plaster bucket above the knee with the leg extended, and with the limb being used daily, is the surest safeguard against flexor contraction, which is otherwise often difficult to prevent.

Stump bandaging and massage are also eliminated by having such a leg worn up to the actual time of applying the final artificial limb.

In the first case of which photographs are submitted herewith, the amputation was done by Dr. M. S. Henderson of the Mayo Clinic in December. I applied the first plaster bucket pylon in February, and the second a few weeks later. The first permanent artificial limb is now being worn, (April 4), and the other will be ready in a week or two. This man has had no contraction deformity; in fact no trouble of any kind.

The other case has quite a different history. He was amputated in February, 1921. He had a dislocation of the hip, which was not reduced until some time after the amputation (August 20). In February, 1922, he was supplied with an artificial limb. There was considerable contracture deformity of the knee and his hip was still tender. He continued to walk on crutches and made an effort to use the artificial leg until March 22. The artificial limb was never of any use for weight bearing. In the meantime he developed a badly pronated foot on the other leg. He was given an anæsthetic on March 30, the flexed knee was straightened and a plaster-of-Paris bucket with a peg leg put on. Whereas the artificial limb had been about 2 inches short, this pylon was made full length. The pronated foot was corrected, and put in plaster. Now with a handicap of an inverted foot in plaster-of-Paris on his good leg, and a plaster bucket extending to above his knee on the amputated leg, he already walks better in a week's time than he has ever been able to do since his amputation.

Fig. 3.—Case 2 after application of pylon and leg cast.

This final case is an argument for three things: first, early correct application of a temporary leg after amputation; second, protection of the foot on the opposite side against pronation; and third, application of the permanent artificial limb only after suitable preparation of the stump.

H. Winnett Orr, M.D., F.A.C.S.
Lincoln, Nebraska.

TRANSACTIONS OF SOCIETIES

CHICAGO SURGICAL SOCIETY

Regular Meeting Held May 5, 1922. Dr. Dean D. Lewis, President

EXSTROPHY OF THE BLADDER

Dr. Jacob Frank: More than 25 years ago I made some experiments on animals in treating exstrophy of the bladder, anastomosing the bladder of the dog with the rectum. At that time I transplanted the ureters for the purpose of finding out whether there would be an ascending infection. My experience showed that in every case where the anastomosis was made to the bowel, there was ascending infection. After making vesicorectal anastomosis in the dog, a year later I brought the dog before the Chicago Medical Society. Dr. Herzog made the bacteriological studies, and it was found that where vesicorectal anastomosis was made, and the openings of the ureters were not destroyed, the kidneys were sterile.

These specimens are now in a museum in Paris; I took them over there 22 years ago at a meeting of the International Medical Congress.

The dogs I operated on were very interesting in this respect: when they wanted to urinate, when they could not urinate through the natural channel, they squatted down like a bitch and urinated through the rectum. The act of urination and of defæcation was controlled separately.

As long as the openings in the ureters are intact the kidneys may remain sterile. Where the openings are destroyed the kidneys are absolutely infected in all cases.

RECURRENCES FOLLOWING OPERATIONS FOR INGUINAL HERNIA

Dr. William Hessert discussed recurrences following operations for inguinal hernia. (See p. 431.)

DISCUSSION

Dr. William Fuller: The so-called sliding and direct herniæ are notoriously difficult to cure surgically regardless of the method employed. It seems to me, however, that it is not these herniæ, for the cure of which the surgeon should be held responsible, but the oblique inguinal hernia, the hernia in which there is also frequent recurrences. The reasons for failure in the former hernia are plain and understandable; in the latter hernia, they are not.

The percentage of failures in every surgeon's work is higher than he would like to admit, or possibly knows. [illegible] patients to return to their surgeon [illegible] ful hernioplasty [illegible] satisfactory. Other patients [illegible] various reasons find it more convenient to consult other surgeons, or possibly none at all.

The statistics of this question will [illegible] one consulting from time to time the surgical instrument makers and truss manufacturers, as I have made it my business to do the past few years. They tell me that [illegible] operation [illegible] truss. Frequently emphasis has been laid upon the fact that as many such reports come from the big surgeon's work as from that of men less well known. The number of patients I see with uncured herniæ is a good index to the number of my failures which wander away and go to other surgeons.

As I see it, there is no single factor that will fully explain the failure to cure a hernia. It seems to me that it may be one of many factors. It may be [illegible] too low ligation of the hernial sac, [illegible] dispute this or did [illegible] sutures tied too tightly or too loosely; to wound infection or one that heals unkindly; or to a patient leaving his bed too early and forming [illegible] kind of scar which had much to do with the production of his hernia.

Dr. Van Sweringen and I did several hundred hernia operations during the war, from which we should have learned some valuable lessons, but personally I can not say that much was really learned. A thing noted in war surgery, seen also in civil surgery, was frequent instances where perfect anatomical development of hernial structures could not be questioned. The operations when smoothly and seemed technically perfect. The wounds healed promptly and the patients were not hurried from their beds; yet many such herniæ [illegible] failures. Again herniæ were met with where structural development was not complete [illegible] operations did not go so well. The wounds healed less kindly, some even becoming infected, yet many of these herniæ did not recur.

Dr. Hessert has long dwelt upon the occasional [illegible] the surgeons' [illegible] have not made, due probably to oversight or lack of proper [illegible] conclusions [illegible]

as has been noted by many surgeons, and this feature some would argue strongly for its possible occasional absence altogether. I believe the strongest point made in the paper is the one of "individualizing" in hernia operations. This I am sure is not always done in the best hands, and rarely, if at all, in other hands. It should be admitted, however, that to exercise this feature with telling effect will not always be possible.

It would appear, therefore, that a careful study should be made of every hernia and that that operation selected which will prove the most useful in that particular instance. Careful handling of all tissues; perfect hæmostasis; high ligation of the hernial sac; obliteration of all dead spaces, especially those likely to appear in the lower part of the wound; structures evenly and accurately approximated by sutures and ligatures tied with precision; and what seems as important as any other item, not allowing the patient to leave his bed until wound healing is strong and complete, or return too early to that environment or employment which might have had much influence in the production of the hernia. Close observation and adherence to these with other features that may arise in hernial operations will have something, no doubt, to do with a perfect and permanent restoration of most herniæ, regardless of whichever "method" one chooses to employ. Nothing will probably lead the average surgeon into trouble and disappointment more quickly than the employment of "methods" and shows nowhere more quickly and decidedly than in his operations for hernia.

Dr. Vernon C. David: I desire to mention one point in connection with sliding herniæ. While the mesentery of the bowel forms a part of the sac, it is not infrequently possible to find some portion of the sac which is parietal peritoneum. This can be opened, extending the peritoneal incision up above the internal ring, so that we virtually have a laparotomy incision parallel to Poupart's ligament, and it will enable us to turn over the sliding portion of the hernia into the abdomen and imbricate the free portion of peritoneum over it, so that the hernia is reduced by imbrication on the sac itself. That has been of great assistance to me in difficult sliding herniæ.

Dr. E. S. Judd, Rochester, Minnesota, read a paper (by invitation) entitled "Ulcer of the Duodenum."

Dr. A. J. Ochsner read a paper entitled "Renal Calculus in the Pelvis of a Floating Kidney with the other Kidney Absent."

Dr. Harry Jackson read a paper entitled "The Circulation of the Cerebrospinal Fluid and Its Relation to Acute Injuries of the Brain."

BOOK REVIEWS

A CRITIQUE OF NEW BOOKS IN SURGERY

SURGICAL complications of dysentery are not frequently encountered in the [illegible], possibly because those types of [illegible] which usually cause complications are comparatively rare here; nevertheless the possibility should be constantly kept in mind. The average textbook records the various pathological conditions which may arise during the course of a dysentery, but the inference is that they are rare, which [illegible] is true. It is, therefore, of interest to read the little volume by Cope[1] which tabulates the author's experience in the Orient in caring for many cases of bowel infections. The frequency of liver abscess with its symptomology, pathology, and treatment is the more essential portion of the work and it is worth any medical man's time and effort to read this as it freshens his memory as to the insiduous course of this condition. We are no doubt seeing more and more cases of disseminated infection, associated with multiple and deep-seated abscess formation, many of them going unrecognized and found only at autopsy. A more careful and painstaking study of the possibilities might lead to more frequent correct diagnosis.

Arthritis, as the author indicates is not [illegible] usual complication of a bowel infection. This in itself should cause us to consider, to a greater extent, a possible etiology for our rather numerous cases of chronic arthritis, and not to pass over the subject of the intestines in the usual superficial manner. This little volume is truly food for thought.

L. A. W.

PROBABLY no European surgeon is more respected and honored in this country than Moynihan; his surgical judgment and technique are respected by all. His enormous experience founded on an unusual intellect and brilliant mind has supplied the medical profession of the world with food for many years. Many of his addresses are unusually instructive and interesting. [illegible] to many more or [illegible]ws, in the end one is convinced that [illegible] right.

In answer to many requests by friends, th[illegible] at hand a little volume of essays by Moynihan.[2] It comprises a series of addresses delivered in the [illegible] professorship [illegible] the last part [illegible] author. The "Murphy Memorial Oration" gives an u[illegible] and courage to dispute the apparently promis[illegible] tabulated in lengthy statistics along with the very [illegible] doubt the operating surgeon has more opportunities to verify his diagnoses than the internest and in many instances he finds his patient suffering from chronic gall-bladder disease or appendicitis rather than from ulcer. The question can rightly be raised as to the value of statistics on gastric ulcer which are not the result of observation on the operating table on the living body. Truly a recovery from a series of symptoms by following a certain medical régime is not conclusive evidence that the patient must have been suffering from a pathological process that these symptoms might indicate.

This little volume contains nine essays, each a [illegible] ordinary stereotype manner but in the author's [illegible]

L. A. W.

[1] Surgical Aspect of Dysentery. By [illegible] Zachary Cope, B.A., M.D., M.S. (Lond.), F.R.C.S. (Eng.). London: Oxford University Press, 192[illegible]

CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

TWELFTH ANNUAL SESSION, BOSTON, OCTOBER 23–27, 1922

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THE HOSPITALS OF BOSTON

THE City of Boston is exceptionally well provided with hospitals. The telephone directory contains a list of 120 large and small institutions for the care of the sick. Many of these are private or semiprivate enterprises, but all are open to visits of medical men.

The following list gives the names of the larger and better known institutions, and it is hoped that every member of the College of Surgeons who comes to Boston in October will inspect most of them.

The Massachusetts General Hospital is situated in the old West End, its grounds bordering upon the Charles River Esplanade. Two years ago this hospital celebrated the one hundredth anniversary of its foundation; there is only one older hospital in the United States. The original building is of New England granite, a stately, restrained, classical structure planned by Bulfinch, the Boston architect who designed also the Massachusetts State House and University Hall, Harvard University. Under the dome of this building is the old operating theater in which was given the first public formal demonstration of complete surgical anæsthesia; the original apparatus, the operating table, the instrument cases and the various furnishings of this room remain today as they were on October 16, 1846, when Dr. John Collins Warren, after removing a tumor of the neck from a sleeping patient, said gravely to the wondering audience, "Gentlemen, this is no humbug!" This announcement, frequently misunderstood, refers to statements which had been freely made in regard to Dr. Morton and his mysterious agent in the weeks preceding this demonstration. Every physician who comes to Boston should see this room in which America's greatest contribution to medical science and practice was given to the world.

The Massachusetts General contains about 450 beds and has a very large outpatient department. The names of its surgeons and physicians, past and present, are known the world over.

The Boston City Hospital, in the South End, was opened May 1, 1864. It is one of the best municipal hospitals in the United States, and refutes the pessimistic impression that city politics and efficient hospital administration are incompatible. At present the total capacity is 1,200 beds; this includes the South Department for Contagious Diseases, a complete and separate plant in its own grounds, on the western side of Massachusetts Avenue; the Convalescent Home in Dorchester, admirably situated in spacious grounds adjoining a park and other open spaces; the Relief Station in Haymarket Square; and the East Boston Relief Station. In addition, a new surgical outpatient department is under con-

struction, which has been pronounced by visiting experts to be as good as anything in the country. The new Thorndike Laboratory will be open for inspection, and perhaps in active operation, in the latter part of October. The X-ray apparatus at present being installed is unexcelled. A great proportion of the traumatic surgery of Boston comes to the City Hospital, and the fracture clinic is enormous; henceforth, whatever the hour it enters, every fracture may be examined and reduced and put into apparatus under direct radioscopic observation.

The Peter Bent Brigham Hospital, in the newer part of Boston, on the edge of the park system and the town of Brookline, contains about 250 beds. It is one of the most recent of Boston hospitals, having been opened in 1913, and is adjacent to the Harvard Medical School. Dr. Henry A. Christian, Hersey Professor of Theory and Practice of Physic, and Dr. Harvey Cushing, Moseley Professor of Surgery in the Harvard Medical School, have been appointed by the trustees of the hospital, physician in chief and surgeon in chief respectively. This hospital is closely affiliated with the Harvard Medical School which it adjoins.

The Robert Brigham Hospital, on Parker Hill, for the care of chronic disease, is at present under the administration of the United States. The original buildings are admirable from the standpoint of hospital practice and add an architectural ornament to that portion of Boston.

The Carney Hospital, in South Boston, situated on Dorchester Heights, contains 175 beds and a large outpatient department. It is built close to the top of the hill which was fortified by General George Washington in 1775. By virtue of these fortifications the British fleet in Boston Harbor was brought under the guns of the American Army and as a result, on March 17, the British fleet departed for Halifax and did not return. This date, a happy combination of a patriotic anniversary and the birth of a favorite saint, has been celebrated enthusiastically by the entire population of South Boston for 150 years.

The Massachusetts Homeopathic Hospital on East Concord Street was founded in 1855. It is a general hospital of 550 beds which is affiliated with Boston University and situated on adjoining land. It is an excellent, well-equipped, and progressive institution.

The Collis P. Huntington Memorial Hospital, erected by the Cancer Commission of Harvard University on the grounds of the Medical School, affords clinical and laboratory facilities for the intensive study and treatment of malignant [illegible] an outpatient department.

The [illegible] Hospital, on [illegible] Street, near the Massachusetts General Hospital, has at present about 50 beds, but is [illegible] a spacious and adequate new building on [illegible] Avenue, directly opposite the [illegible] School. In [illegible] delivered in the hospital, and about 1,300 in their own homes by the hospital exter[illegible]

The Boston Dispensary, on [illegible] contains a well-equipped ward of 30 beds for children, but does most of its work in its outpatient department and by visits to patients' homes. [illegible] were made in 1918.

The Children's Hospital, adjoining the Medical School, possesses an admirable plant of about 250 beds. Nearly 5,000 ward patients and more than 40,000 outpatients were treated during the past year.

The Massachusetts Charitable Ear and Eye Infirmary, on Charles Street near the Massachusetts General Hospital, is one of the largest institutions of its kind in the world. It contains more than 200 beds, treats in the wards 4,500 patients, and receives 75,000 visits from outpatients each year.

The United States Naval Hospital recently extensively enlarged has a commanding situation in Chelsea overlooking the harbor. It cares for large numbers of veterans of the World War, in addition to the personnel of the navy. It has [illegible] beds.

The New England Hospital for Women and Children is pleasantly situated on spacious grounds in Roxbury. It has 175 beds, and its active staff is composed exclusively of women doctors.

The Forsyth Infirmary, a very beautiful and well-planned building in the Fenway, gives free dental service to the school children of Boston. Facio-maxillary surgery is also a specialty here.

The Cambridge Hospital located on the banks of the Charles River in Cambridge is a very well-equipped modern hospital of 175 beds.

The Free Hospital for Women, in Brookline, has about 100 beds and a large outpatient department. It is beautifully situated on the edge of the Boston park system, near Brookline village.

St. Elizabeth's Hospital, in Brighton, possesses a new and very [illegible] beds. Its [illegible] department is large and well outfitted.

Besides these, there are the Boston State Hospital of about 3,000 beds, near Franklin Park, for neurotic and mental cases, the MacLean Hospital, with 200 beds, a part of the Massachusetts General Hospital, for similar cases; the Long Island Hospital, with 500 beds, in Boston Harbor, for the care of the chronic sick of the city; the Good Samaritan Hospital near the Medical School; and the Boston Psychopathic Hospital for the observation of acute, curable, incipient, and doubtful cases of mental disease.

It is obvious from the foregoing, which by no means exhausts the list, that Boston does not lack efficient hospitals. Other institutions of great interest are the Boston Medical Library and Harvard, Tufts, and Boston University Medical Schools. The Boston Medical Library, the third medical library in point of size in the United States, is situated on the Fenway in the Back Bay. All of these institutions extend a cordial welcome to the members of the College of Surgeons and their guests.

THE CLINICAL CONGRESS IN BOSTON

IN a general way the plans for the twelfth annual session to be held in Boston, October 23 to 27, conform to those of previous sessions of the Congress. Clinical demonstrations in the hospitals, laboratories, and medical schools will fill the morning and afternoon hours of each of the four days—Tuesday to Friday inclusive.

The preliminary program of clinics and demonstrations as published in the following pages gives one an excellent idea of the variety and scope of the clinical work to be demonstrated. The real program of the Congress will be bulletined at the headquarters each afternoon during the session, and will present in great detail a complete list of the operative clinics and demonstrations to be given in the several hospitals, laboratories, and schools.

The Committee on Arrangements plans to provide a program that will completely represent the clinical activities of that great medical center. All departments of surgery will be represented, including gynecology, obstetrics, orthopedics, urology, surgery of the eye, ear, nose, throat and mouth, experimental surgery, surgical pathology, roentgenology, etc. An outstanding feature of the clinical program will be a series of special demonstrations that have been arranged in several of the hospitals in which members of the medical staff will participate.

On Monday morning at 9:30 and at 2:30 in the afternoon a conference on the problems related to the hospital standardization program of the College will be held in Jordan Hall. The program therefor is published in the following pages. A similar conference at the Philadelphia meeting in 1921 proved to be a decidedly interesting and instructive feature, and it is expected that a further discussion of these matters will add to the interest in this department of the College work. The annual approved list of hospitals which, on inspection, fulfill the requirements of the minimum standard of the College will be released on this day.

The presidential meeting—the first formal session of the Congress—will be held on Monday evening in Symphony Hall. Dr. Harvey Cushing will be inaugurated as President and will deliver his inaugural address. The retiring president, Dr. John B. Deaver, will review briefly the work of the past year. Professor Raffaele Bastianelli of Rome, Italy, will deliver the John B. Murphy Oration in Surgery, his subject being "Surgery of the Joints." At this meeting the distinguished foreign guests will be presented.

Tuesday and Thursday evenings will be devoted to scientific sessions in Jordan Hall at which a series of interesting papers dealing with surgical subjects of present-day importance will be presented by eminent American and European surgeons. In the same hall on Wednesday evening Fellows of the College and their ladies will be guests of the Boston Surgical Society at a special meeting, the occasion being the presentation of the Henry Jacob Bigelow medal to Dr. William Williams Keen of Philadelphia.

The tenth convocation of the American College of Surgeons will take place on Friday evening in Symphony Hall at which time Fellowship in the College will be conferred upon a group of American and Canadian surgeons and honorary Fellowships upon a number of the distinguished guests. The Fellowship Address will be delivered by Professor Raffaele Bastianelli. The complete program for all of the evening sessions will be found in the following pages.

The following distinguished Latin-American surgeons are expected to attend the Clinical Congress: Dr. José E. Casuso, Dr. José A. Presno, and Dr. Rafael Menocal of Havana, Cuba; Dr. Gabriel M. Malda and Dr. Ulises Valdes of Mexico; Dr. José Arce of Buenos Aires, Argentina; Dr. Claudio J. Sanjines of La Paz,

Bolivia; Dr. Olympio da Fonseca of Rio de Janeiro, Brazil; Dr. Gregorio Amunotegui and Dr. Lucas Sierra of Santiago, Chile; Surgeon-General Alberto Adriasola and Dr. Guillermo E. Muennich of Valparaiso, Chile; Dr. Pompilio Martinez of Bogotá, Colombia; Dr. Francisco Graña of Lima, Peru; Dr. Enrique Pouey of Montevideo, Uruguay; and Dr. Louis Razetti of Caracas, Venezuela.

HEADQUARTERS

General headquarters for the Congress will be at the Copley Plaza Hotel, which is centrally located in the Back Bay district. The large ballroom of the hotel, foyers adjacent thereto, with other large rooms on the main floor, have been reserved for the use of the Congress, affording ample space for registration and ticket bureaus, bulletin rooms, etc.

Headquarters will be open for registration at 12 M. Monday, October 23. The clinical program for Tuesday will be bulletined during the afternoon, and tickets for Tuesday's clinics will be issued as visiting surgeons register.

REDUCED RAILWAY FARES

The railways of the United States and Canada with but few exceptions have authorized the sale of round-trip tickets to Boston on account of the Clinical Congress at one and one-half the ordinary one-way fare, provided that the journey be made by the same route in both directions. Round-trip tickets at the reduced rate will be sold to members only upon presentation of identification certificates issued from the office of the Director-General. Such identification certificates will be issued to all who register in advance, one certificate being sufficient for the individual surgeon and dependent members of his family. Under this arrangement round-trip tickets will be sold from October 19 to 25 in the central and eastern states, and eastern Canada, with a final return limit of November 2.

In the far western states and the western provinces of Canada the earliest selling date is October 18, with a return limit of November 3.

The reduction in fares does not apply to Pullman fares or to excess fares charged for passage on certain trains. Local railway ticket agents will supply detailed information with regard to rates, routes, etc.

SPECIAL TRAIN FROM CHICAGO TO BOSTON

For the convenience of members from the West who will attend the meeting in Boston, the New York Central Railroad will undertake to provide a special train leaving Chicago [illegible] a.m., Sunday, October 22, arriving in Boston at 10 a.m., Monday. This special train will duplicate the equipment of the "Twentieth Century," including standard Pullman sleeping, compartment, club, observation, and dining cars. No extra fare will be charged for passage on the special train, and members are urged to make their reservations therefor at the earliest possible date. This arrangement is contingent upon reservations for such special train being made by the minimum number required by the Interstate Commerce Commission rules.

LIMITED ATTENDANCE—ADVANCE REGISTRATION

Because of the popularity of these annual clinical meetings it has been found necessary in recent years to adopt the plan of limiting attendance to a number that can be comfortably accommodated. The limit of attendance is based upon the result of a survey of the amphitheaters, lecture rooms, and laboratories of the several hospitals and medical schools as to their capacity for accommodating visitors. This plan requires registration in advance on the part of all who expect to attend, and when the limit of attendance has been reached through such advance registration at the office of the College, no further applications will be accepted. This plan insures accommodations at the clinics for all who register in advance, and the necessity for adopting such a plan will be apparent to all. There has been a very large advance registration, and it is probable that the limit of attendance will be reached some weeks in advance of the meeting.

CLINIC TICKETS

Attendance at all clinics and demonstrations is controlled by means of special clinic tickets. This has proven an efficient means of providing for the distribution of the visiting surgeons among the several clinics, and insures against overcrowding. The number of tickets issued for any clinic is limited to the capacity of the room in which that clinic is to be given. Tickets are issued at headquarters each morning at 8 o'clock.

Each afternoon during the session, a complete program of the following day's clinics will be posted on bulletin boards at headquarters. After the program has been so posted, reservations for tickets for the next day's clinics may be filed, the clinic tickets to be issued the following morning at 8 o'clock. A printed program will be issued each morning which will contain the complete clinical program for the day, with announcements of evening sessions and other information.

REGISTRATION FEE

Plans for the Congress provide that no financial burden may be imposed upon the members of the profession in the city entertaining the Congress. Hence a registration fee of $5.00 is required of each surgeon attending the annual clinical meeting, such fees providing the funds from which to meet the expenses of conducting the meeting. To each surgeon on registering in advance is issued a formal receipt for the registration fee, which receipt is to be exchanged for a general admission card upon his registration at headquarters in Boston. This card, which is non-transferable, must be presented to secure special clinic tickets and for admission to the evening meetings.

HOTEL ACCOMMODATIONS

The Committee on Arrangements has appointed a Committee on Hotels, with Dr. Stephen Rushmore as chairman, to aid Fellows in securing hotel accommodations during the Boston meeting. Boston has ample hotel facilities, many first class hotels being located within walking distance of headquarters. Fellows are requested to make their applications for accommodations direct to the hotels named in the list recommended by the Committee as printed below. If difficulty is experienced in securing satisfactory accommodations the matter should be taken up with Dr. Rushmore, 520 Commonwealth Avenue, Boston.

BOSTON HOTELS WITH RATES

	Single Room		Double Room	
	With Bath	Without	With Bath	Without
Adams House, 533 Washington St			6.00 7.00	3.50 4.50
American House, 50 Hanover St			6.00	4.00
Arlington, 18 Chandler St	2.50 3.00		4.00 5.00	
Avery, 4 Avery St			6.00	
Bellevue, 21 Beacon St			8.00–10.00	4.00–6.00
Brewster, 20 Boylston St	3.00–4.00	2.50–3.00	5.00 7.00	
Brunswick, Boylston and Clarendon	4.00	3.00	6.00– 7.00	5.00
Buckminster, 641 Beacon St	3.00	2.50	6.00	5.00
Commonwealth, Bowdoin St			5.00	
Copley Plaza, Copley Square	6.00		11.00	
Copley Square, 49 Huntington Ave	4.00		6.00	
Essex, 643 Atlantic Ave	5.00	3.00–3.50	7.00– 8.00	
Fritz-Carleton, 1138 Boylston St		3.00	8.00–10.00	4.50
Garrison Hall, 8 Garrison St	3.00		5.00	
Langham, 1699 Washington St	3.00	2.00	4.00	3.00
Lenox, Exeter and Boylston	5.00	3.50	8.00	5.00
Parker House, School and Tremont	5.50–7.00	4.00–4.50	5.50 7.00	5.00
Plaza, 419 Columbus Ave			5.00	3.00
Priscilla (women only), 307 Huntington Ave	3.00		4.50 6.00	
Puritan, 390 Commonwealth Ave	5.00	2.50	6.00	
Putnam, 284 Huntington Ave		2.00–3.00		3.00–4.00
Quincy, 47 Brattle St	3.50	2.00–2.50	6.00– 7.00	3.50–4.00
Ranelegh, 11 Mountfort St			5.00	
Somerset, Commonwealth and Charlesgate			10.00	5.00
Stewart Club (women only), 102 Fenway		3.50		6.00
United States, 90 Beach St		2.50		4.00
Vendome (American plan), Commonwealth and Dartmouth	8.00		14.00–16.00	
Victoria, 271 Dartmouth St	4.00	3.00	6.00	5.00
Westminster, Copley Square	4.00	2.50	7.00	3.50
Young's Court and City Hall			7.00– 8.00	4.50–5.00

PROGRAM FOR EVENING MEETINGS

Presidential Meeting, Monday, October 23—Symphony Hall, 8 P.M

Address of Welcome: LINCOLN DAVIS, M.D., Boston, Chairman of Committee on Arrangements.

Address of the retiring president: JOHN B. DEAVER, M.D., Philadelphia.

Introduction of foreign guests: [illegible]

M.D., Stockholm.

Inaugural Address: HARVEY CUSHING, M.D.

The Doctor John B. Murphy Oration in Surgery—"Surgery of the Joints": RAFFAELE BASTIANELLI, M.D., F.R.C.S. (Hon.), Rome.

Tuesday, October 24—Jordan Hall, 8 P.M.

EINAR KEY, M.D., Stockholm: Treatment by Embolectomy of Circulatory Disturbances in the Extremities Due to Emboli.

SYMPOSIUM: Genito-Urinary Surgery.

HUGH H. YOUNG, M.D., Baltimore: Prostatectomy—Preparatory, Operative, and Postoperative Methods.

FRANCIS SEYMOUR KIDD, M.Ch., F.R.C.S., London: Simple Mesodermal Tumors of the Urinary Bladder; with the Report of a Case Treated by Operation.

ANDREW FULLERTON, C.B., C.M.G., Belfast: A Note on Unilateral Di[illegible]

J. BENTLEY SQUIER, M.D., New York: The Surgery of Vesical Neoplasms.

Discussion: WILLIAM C. QUINBY, M.D., Boston; ALEXANDER RANDALL, M.D., Philadelphia; JOHN T. GERAGHTY, M.D., Baltimore; JOHN H. CUNNINGHAM, M.D., Boston.

Wednesday, October 25—Jordan Hall, 8:30 P.M

SPECIAL MEETING [illegible]

Introductory Remarks: ROBERT W. LOVETT, M.D., Boston, President.

Presentation of Henry J. Bigelow Medal to WILLIAM WILLIAMS KEEN, M.D., Philadelphia

"Sixty Years Ago—1862 to 1922": WILLIAM WILLIAMS KEEN, M.D., Philadelphia.

Thursday, October 26—Jordan Hall, 8 P.M.

SYMPOSIUM: Carcinoma of the Jaws, Tongue, and Cheeks and Lips.

GEORGE W. CRILE, M.D., Cleveland: General Principles Involved in Operations; Summary of Results Obtained in the Crile Clinic, with Special Reference to Treatment of Carcinoma of the Ja[illegible]

EDWARD S. JUDD, M.D., Rochester, Minn.: Summary of Results Obtained in the Mayo Clinic, with Special Reference to Treatment of Cancer of the Tongue.

GEORGE E. BREWER, M.D., New York: Summary of Results Obtained in the Presbyterian, Memorial, and Roosevelt Hospitals of New York, with Special Reference to Treatment of Cancer of the Cheeks and Lips.

Discussion: ROBERT B. GREENOUGH, M.D., Boston; ALBERT J. OCHSNER, M.D., Chicago; VILRAY P. BLAIR, M.D., St. Louis; JOSEPH C. BLOODGOOD, M.D., Baltimore; DOUGLAS QUICK, M.D., New York; GEORGE P. MULLER, M.D., Philadelphia; HARVEY R. GAYLORD, M.D., Buffalo; ALEXANDER E. GARROW, M.D., Montreal; CHANNING C. SIMMONS, M.D., Boston.

Friday, October 27—Symphony Hall, 8 P.M.

CONVOCATION OF THE AMERICAN COLLEGE OF SURGEONS

Invocation: REVEREND DOCTOR ALEXANDER MANN, L[illegible]

Conferring of Honorary Fellowships.

Presentation of Candidates for Fellowship.

Presidential Address: HARVEY CUSHING, M.D., Boston.

Fellowship Address: RAFFAELE BASTIANELLI, M.D., F.R.C.S. (Hon.), Rome.

HOSPITAL CONFERENCE

MONDAY, OCTOBER [illegible], IN JORDAN HALL

Morning Session, 9:30 to 12:30

JOHN B. DEAVER, M.D., F.A.C.S., President, Presiding

Report on the Standardization Activities of the College in 1922
FRANKLIN H. MARTIN, M.D., F.A.C.S., Director-General, American College of Surgeons

The Doctor and the Hospital
FREDERIC A. WASHBURN, M.D., Superintendent, Massachusetts General Hospital, Boston

The Minimum Standard and Its Application to Hospitals
FREDERICK W. SLOBE, M.D., Hospital Standardization Department, American College of Surgeons

What Real and Lasting Benefit Has Come to the Patient from Hospital Standardization?
CHARLES B. MOULINIER, S.J., President, Catholic Hospital Association

The American Hospital
A. R. WARNER, M.D., Executive Secretary, American Hospital Association

Hospital Standardization from a Public Health Standpoint
D. A. CRAIG, M.D., Provincial Commissioner, Nova Scotia Division, Canadian Red Cross, Halifax, Nova Scotia

Hospital Standardization from the Viewpoint of the Medical Staff
R. A. HUGHES, M.D., Moncton, New Brunswick

Side-lights on Hospital Standardization
ROBERT JOLLY, Superintendent, Baptist Hospital, Houston, Texas

The Analysis of End-Results
EUGENE H. POOL, M.D., F.A.C.S., New York, and E. A. CODMAN, M.D., F.A.C.S., Boston

General Summary of Hospital Standardization
MALCOLM T. MACEACHERN, M.D., C.M., Director-General, Victorian Order of Nurses for Canada

Afternoon Session, 2 to 4:30—General Round Table Discussion

Conducted by MALCOLM T. MACEACHERN, M.D., C.M.

The Round Table Discussion will be confined largely to the requirements of the Minimum Standard. Hospital superintendents, staff members, and members of boards of trustees are urged to send in questions which they desire to be answered, in order that the discussion may shed light on the various difficulties encountered. After representative speakers have opened the discussion of these questions, the subsequent discussion will be open to all. A tentative list of the topics to be considered follows:

I. Staff Organization:
   1. The selection of the exact type of staff organization best suited to local needs.
   2. The division of responsibility into representative committees.
   3. The initial organization of the staff conference.
   4. The agenda and detailed description of the staff conference.
   5. Methods of stimulating interest and enthusiasm in staff conferences.
   6. Monthly analysis of hospital work.

II. Case Records:
   1. The component parts of a case record.
   2. Methods of securing the records.
   3. Methods of stimulating increased interest in the records.
   4. The hospital historian or record-clerk.
   5. Filing systems, special indices, disease nomenclature, and follow-up systems.

III. Laboratories and X-ray facilities:
   1. Methods of stimulating increased use of laboratories by the medical staff.
   2. Relationship of laboratory charges to laboratory service, and the various systems of laboratory charges commonly employed.
   3. The extent to which routine laboratory examinations should be employed.
   4. Laboratory facilities in the small hospital.
   5. Laboratory reports and filing systems.
   6. What should constitute the complete service in an X-ray department?
   7. The interpretation of X-ray plates by roentgenologist versus interpretation by individual physicians.
   8. To what extent can X-ray facilities outside of the hospital be used satisfactorily?

IV. Miscellaneous:
   1. What points in particular should the hospital surveyor investigate in making his annual visit?
   2. Making the public understand the value of hospital standardization.
   3. Methods of increasing the efficiency of the hospital survey of the College.

It should be clearly understood that all are urged to take part in the Round Table. Including the speakers of the morning program, the following names are a partial list of those who have been invited to lead in the discussion:

John G. Bowman, Chancellor, Pittsburgh University, Pittsburgh

Pliny O. Clark, President, Protestant Hospital Association
H. E. Webster, Superintendent, Royal Victoria Hospital, Montreal
W. C. Rappleye, Rockefeller Foundation
Horace G. Wetherill, M.D., F.A.C.S., Denver
Brigadier General C. E. Sawyer, M.C., U.S.A.
Joseph B. Howland, M.D., Superintendent, Peter Bent Brigham Hospital, Boston
George W. Swift, M.D., F.A.C.S., Seattle
E. T. Dillon, M.D., F.A.C.S., Los Angeles
Roy C. Kingswood, M.D., London, Ontario
Rev. Newton E. Davis, Executive Secretary, Conference Board of Hospitals and Homes of Methodist Episcopal
Matthew O. [illegible] Medical Director, Henry Phipps Institute, Chicago
S. S. Goldwater, M.D., Superintendent, Mt. Sinai Hospital, New York City
Joseph J. [illegible] Medical Director, Henry Phipps Institute, Chicago
Frank E. Chapman, Superintendent, Mt. Sinai Hospital, Cleveland
Henry M. [illegible] M.D., Medical Director, Homeopathic Hospital, Boston
R. M. Harbin, M.D., F.A.C.S., Rome, Georgia
Charles A. Gordon, M.D., F.A.C.S., Brooklyn
John M. Baldy, M.D., F.A.C.S., Philadelphia
A. K. Haywood, M.D., Superintendent, Montreal General Hospital, Montreal

PRELIMINARY CLINICAL PROGRAM FOR BOSTON MEETING

MASSACHUSETTS GENERAL HOSPITAL

Tuesday, October 24

C. A. Porter, G. W. W. Brewster, R. B. Greenough, Hugh Williams, and associates—9. General surgical operations.

Surgical Staff Clinic—2.

C. A. Porter, J. H. Means, E. P. Richardson, and G. W. Holmes—Surgery of the thyroid gland.
T. W. Harmer—Tendon surgery.
Chester Jones—Bile analysis.
D. F. Jones—Pancreatitis.
W. J. Mixter, J. B. Ayer, and John S. Hodgson—Neurological surgery.
C. L. Scudder and H. F. Hewes—Chronic gastric ulcer.
Beth Vincent—Plastic surgery.
Wyman Whittemore—Surgery of the lung.

Wednesday, October 25

Orthopedic Operations and Demonstrations—9.

Smith Peterson—Arthrodesis of sacro-iliac joint.
M. H. Rogers—Arthrodesis of hip joint.
Z. B. Adams—Reduction of congenital dislocation of the hip.
R. B. Osgood—Excision of semilunar cartilage or excision of knee joint.
P. D. Wilson—Syme amputation.
L. T. Brown—Spinal fusion.
R. N. Hatt—Stoeffel operation for spastic paraplegia.
Z. B. Adams—Keller's operation for hallux valgus.

Demonstration of Orthopedic Cases—.

P. D. Wilson—Results of Syme amputation, apparatus.
R. B. Osgood—Multiple myeloma, report of cases with pathological specimens.
E. G. Brackett—Orthopedic surgery in China.
Smith Peterson—Correction of deformities of the hip by arthrodesis, results.
Mark H. Rogers—Results of treatment of intractable sciatica by arthrodesis of the sacro-iliac joint.
Z. B. Adams—Possibility of reducing congenital dislocation of the hips in children over seven.
L. T. Brown—Results of operative treatment of tuberculosis of the spine in adults.
J. E. Goldthwait—Physical development in cantonment training camps.

Thursday, October 26

D. F. Jones, Lincoln Davis, [illegible] Associates—General surgical operations.

Staff Clinic: Symposium on Malignant Disease—.

R. B. Greenough—Malignant [illegible] remarks.
D. F. Jones—Cancer of the rectum.
R. B. Greenough—Cancer of the breast.
D. C. Gleason—Cancer of the cervix.
Lincoln Davis and G. A. Leland—Cancer of the uterus.
Channing Simmons—Osteogenetic sarcoma.
G. W. Holmes—X-ray as a prophylactic and in palliative treatment.
H. P. Mosher—Cancer of the [illegible]
C. L. Scudder and H. F. Hewes—[illegible]

Friday, October 27

R. B. Greenough and D. F. Jones—General surgical operations.
J. D. Bapst—[illegible] operations.

Surgical Clinic: Staff—.

J. D. Bapst—Pneumoperitoneum [illegible]
G. G. Smith—Treatment of [illegible] joints.
R. F. O'Neil.
E. G. Crabtree—Surgical approach of the lower end of the ureter.
H. H. Cragin—[illegible] ureter.
G. G. Jones—Methods of [illegible] in the urine.
D. F. Jones—[illegible] Medical School.

BOSTON CITY HOSPITAL

Tuesday, October 24

F. B. Lund—General surgical operations.
J. B. Ayer—Gynecological operations.
F. C. Hayes and [illegible] Dr. [illegible] surgery.
O. J. Herman—2. Intestinal gunshot wounds.
J. B. Ayer—[illegible] miscarriages.

G. L. Vogel and associates—2. Ear and throat cases.
T. M. Freeman—1. Carcinoma of soft palate and larynx.
E. J. Monohan—2. Tonsillectomy in acute disease.

Wednesday, October 25

J. C. Hubbard and associates—9. General surgical operations.
G. L. Vogel and associates—9. Ear and throat operations.
F. B. Lund—2. Demonstrations: carcinoma of stomach; carcinoma of tongue, facial nerve anastomosis, results of operations.
I. J. Walker—1. Echinococcus cyst of liver, resection of stomach, three cases; oral cancer, radium, three cases.
Stephen B. Maguire and W. H. Canavan—1. Cases of dental surgery.

Thursday, October 26

H. A. Lothrop and associates—9. General surgical operations.
Paul Thorndike and associates—9. Genito-urinary operations.
F. J. Cotton and associates—2. Demonstrations: operation for recurrent dislocation of shoulder; series of cases of artificial ligaments in loose knees; arthroplasty, Putti technique; operation for flat-foot, new technique: pelvic fracture cases; Colles fracture results.
P. F. Butler and A. W. George—2. Surgical X-rays.

Friday, October 27

F. J. Cotton and associates—9. General surgical operations.
H. A. Lothrop and associates—2. Demonstration of surgical cases.
Horace Binney—2. Gangrene of the lung; abscess of the lung; separation of the lower epiphysis of the femur; certain type of fracture of the forearm.
A. R. Kempton—2. Tumor of carotid body.
H. B. Stevens and associates—2. Ophthalmic surgery.
J. J. Corbett—2. Series of cataract operations.

CHILDREN'S HOSPITAL

Tuesday, October 24

R. W. Lovett and associates—9. Orthopedic operations.

Surgical Staff Clinic—9.

W. E. Ladd—Harelip cases (with lantern slides).
C. G. Mixter—Undescended testicle.
J. S. Stone—Pneumoccocus peritonitis; omental tumors.
G. D. Cutler—Teratoma; webbed fingers.
T. H. Lanman—Hæmangiomata.
J. S. Stone and associates—2. General surgical operations.

Orthopedic Staff Clinic—2.

Robert Soutter—Obstetrical paralysis.
A. T. Legg—Pathology and treatment.
J. W. Sever.
J. H. Fitzsimmons—Clubfoot.
R. F. Ober—Treatment and operative means.

Wednesday, October 25

A. R. Lovett and associates—9. Orthopedic Clinic Fractures of the spine in industrial accidents; results of stabilizing operations for weak or frail joints in poliomyelitis.
F. R. Blumenthal—9. Cases of orthodontia.
J. S. Stone and associates—9. General surgical operations.
R. W. Lovett and associates—2. Orthopedic operations.

Surgical Staff Clinic—2.

Bronson Crothers—Injuries of spinal cord in childbirth.
George D. Cutler—Meningocele.
James S. Stone—Spina bifida occulta.
William F. Ladd—Megacolon.
Charles G. Mixter—Congenital defect of bile ducts.

Thursday, October 26

R. W. Lovett and associates—9. Orthopedic operations.

Surgical Staff Clinic—9.

T. H. Lanman—9. Skin grafts.
W. E. Ladd—9. Cases of plastic surgery.
G. D. Cutler—9. Ruptured kidney.
C. G. Mixter—9. Tumors of the kidney, chronic pyelitis.
James S. Stone and Oscar M. Schloss—9. Pyloric stenosis and spasm.
D. Crosby Greene—9. Cases of laryngeal and œsophageal stricture.
J. S. Stone and associates—2. General surgical operations.
R. W. Lovett and associates—2. Orthopedic clinic: Congenital dislocations of hip, results of operative treatment; Legg-Calvé disease, pathology and treatment; relief of contracture of the hip.

Friday, October 27

J. S. Stone and associates—9. General surgical operations.
R. W. Lovett and associates—9. Orthopedic clinic: Infantile paralysis, results in treatment clinic; muscle and tendon transplantation, the result of treatment; transplantations of the tensor fasciæ femoris for paralysis of the abductors.
R. W. Lovett and associates—2. Orthopedic operations.

Surgical Staff Clinic—2.

W. E. Ladd—Intussusception.
C. G. Mixter—Intestinal obstruction.
G. D. Cutler—Intestinal obstruction by Meckel's diverticulum.
J. S. Stone and O. M. Schloss—Atypical cases of appendicitis in children; differential diagnosis.

MASSACHUSETTS HOMEOPATHIC HOSPITAL

Tuesday, October 24

J. Emmons Briggs and W. S. K. Thomas—9. Surgery of the stomach, operations.
D. W. Wells and associates—9. Operations on the eye.
A. G. Howard—9. Orthopedics.
Conrad Smith—9. Nose and throat clinic.
D. W. Wells—9. Eye clinic.
S. W. Ellsworth—9. Lesions of the gastro-intestinal tract.
C. T. Howard and W. S. K. Thomas—2. General surgical operations.
A. W. Rowe and W. L. Mendenhall—2. Vital function tests in relation to surgery.

Wednesday, October 25

T. E. Chandler and H. J. Lee—9. Gynecological operations.
Conrad Smith, E. R. Johnson, and C. W. Bush—9. Nose and throat operations.
A. G. Howard—9. Demonstration: back strain.
T. E. Chandler and H. J. Lee—2. Gynecological operations.
A. S. Begg and F. H. Pratt—2. Anatomical and physiological demonstrations.

Thursday, October 26

C. F. Howard and [illegible] the biliary tract.
F. W. Colburn and H. L. Babcock—9. Operations on the ear.
A. G. Howard—9. Orthopedic.
Conrad Smith—9. Nose and throat clinic.
S. W. Ellsworth—9. Demonstration, with particular reference to differential diagnosis of diseases of the larynx.
J. Emmons Bergin and Charles [illegible] surgery; operative clinic.
W. H. Watters—2. Clinico-pathological [illegible] and medico-legal autopsies.
D. L. Belding—2. Wassermann test in surgical diagnosis.
S. B. Hooker—2. The [illegible] bility tests preliminary to blood transfusion.
Helmuth Ulrich—2. Blood tests in surgery.

Friday, October 27

A. G. Howard—9. Orthopedic operations.
D. W. Wells—9. Eye clinic.
R. C. Wiggin—2. Genito-urinary surgery; operative clinic.

FREE HOSPITAL FOR WOMEN

Tuesday, October 24

W. P. Graves, F. A. Pemberton, and R. G. Wadsworth—9. Gynecological operations.

Wednesday, October 25

W. P. Graves, and F. A. Pemberton—9. Gynecological operations.
W. P. Graves—2. Clinic on procidentia, radium and cancer of the uterus.

Thursday, October 26

W. P. Graves, F. A. Pemberton, and H. W. Ballou—9. Gynecological operations.
F. A. Pemberton—2. Clinic on diseases of the female urethra.

CARNEY HOSPITAL

Tuesday, October 24

H. L. Johnson and L. E. Phaneuf—9. Gynecological operations.
L. E. Phaneuf—2. Gynecological clinic.

Wednesday, October 25

J. T. Bottomley, D. F. Mahoney, and A. McK. Fraser—9. General surgical operations.
C. M. Proctor—2. Oral surgery.
W. E. Browne—2. End results and demonstration of traumatic hands.

Thursday, October 26

W. R. MacAusland and A. R. MacAusland—9. Orthopedic operations.
W. R. MacAusland and A. R. MacAusland—2. Orthopedic demonstrations.

Friday, October 27

J. T. Bottomley, D. F. Mahoney, and A. McK. Fraser—9. General surgical operations.
D. J. Hurley and T. J. Shanahan—[illegible] throat operations

PETER BENT BRIGHAM HOSPITAL

Tuesday, October 24

Harvey Cushing, W. [illegible] John Homans, and E. [illegible] cal operations.
David Cheever, John Homans, [illegible] and E. C. Nichols—[illegible] general surgical cases.

Wednesday, October 25

Harvey Cushing, W. [illegible] John Homans, and E. [illegible] surgical operations.
Harvey Cushing, Gilbert Horrax, and Edward Bangs—Clinical demonstrations in genito-urinary surgery.

Thursday, October 26

Harvey Cushing, W. [illegible] John Homans, and E. [illegible] surgical operations.
W. [illegible] Clinical demonstrations in genito-urinary surgery.

Friday, October 27

Harvey Cushing, W. [illegible] John Homans, and E. [illegible] surgical operations.

ST. ELIZABETH'S HOSPITAL

Tuesday, October 24

Arthur Chute—9. Genito-urinary operations.
Arthur Chute—2. Genito-urinary operations.

Wednesday, October 25

Joseph Stanton and Henry Rowen—9. General surgical operations.
George Keenan and Francis Janszen—[illegible] gical operations.

Thursday, October 26

Joseph Stanton and Henry Rowen—9. General surgical operations.
George Keenan and Francis Janszen—[illegible] gical operations.

Friday, October 27

Thomas Broderick—9. Orthopedic operations.
Charles Kneeland—9. Gynecological operations and obstetrical ward visit.

BOSTON LYING IN HOSPITAL

Tuesday, October 24

R. S. [illegible] Hemorrhage [illegible] of the placenta.
Donald Munro—2. Intracranial hæmorrhage in the newborn.

Wednesday, October 25

E. S. Nevins—[illegible] thesia.
F. C. Irving—2. Abdominal abortion with sterilization.
B. E. Hamilton—2. Cardiac complications of pregnancy.

Thursday, October 26

E. S. Nevins—[illegible]

BOSTON DISPENSARY

Tuesday, October 24

John D. Adams and associates—9. Orthopedic operations. Hip disease, tuberculosis of spine, club foot; rigid flat-foot.

Staff Clinic in Out Patient Department—9.

H. F. Day and associates—General surgical cases.
Maynard Ladd and associates—Pediatrics.
Malcolm Storer and associates—Gynecology.
W. E. Chenery and H. J. Inglis—Nose and throat clinic.
John D. Adams and associates—Orthopedic clinic.
T. C. Hill and F. P. Williams—Diseases of the rectum.
A. H. Crosbie and associates—Genito-urinary cases.
H. F. Perry and associates—Diseases of the skin.
J. D. Adams and associates—2. End-results, tuberculosis of spine, club foot; non-operative treatment of acute hip infection. Occupational therapy (with lantern slides).

Wednesday, October 25

H. F. Day and associates—9. Surgical operations: Inguinal hernia in the child, ingrowing toe nail, septic hand, an industrial injury.
F. P. Williams, T. C. Hill, and associates—9. Fissure in ano, internal haemorrhoids.

Staff Clinic in Out Patient Department—9.

H. F. Day and associates—General surgery.
Maynard Ladd and associates—Pediatrics.
Malcolm Storer and associates—Gynecology.
W. E. Chenery and H. J. Inglis—Nose and throat clinic.
John D. Adams and associates—Orthopedics.
T. C. Hill and F. P. Williams—Diseases of the rectum.
A. H. Crosbie and associates—Genito-urinary clinic.
H. F. Perry and associates—Diseases of the skin.

Staff Clinic and Short Talks—2.

Benjamin Tenney—Some points in the anatomy and surgery of the knee joint.
W. P. Coues—Bone syphilis.
R. H. Gilpatrick—Ankylosis of the jaw.
W. F. Temple—Out-patient anæsthesia.
F. G. Barnum—Osteomyelitis.
T. C. Hill—Out-patient treatment of rectal diseases.
Oliver G. Tinkham—Fracture of the elbow joint.
Carl Bearse—Adaptation of amputation stumps to artificial limbs.
J. J. Lynch, Jr.—Cervical adenitis.
John J. Murphy—Abdominal diagnosis in the out-patient department.
H. F. Day—Peritonitis following tonsillar infection.

Thursday, October 26

W. E. Chenery and H. J. Inglis—9. Nose and throat operations.
H. J. Inglis—9. X ray diagnosis of diseases of nasal sinuses.

Staff Clinic in Out-Patient Department—9.

H. F. Day and associates—General surgery.
Maynard Ladd and associates—Pediatrics.
Malcolm Storer and associates—Gynecology.
W. E. Chenery and H. L. Inglis—Nose and throat clinic.
T. C. Hill and F. P. Williams—Diseases of the rectum.
A. H. Crosbie and associates—Genito-urinary clinic.
H. F. Perry and associates—Diseases of the skin.

Clinic by Staff—2.

W. E. Preble—Postoperative care of patients.
Herman Osgood—X-ray treatment.
A. K. Paine—Treatment of gonorrhœa in women.
L. H. Spooner—Health clinic.
Maynard Ladd and Hilbert T. Day—Pyloric stenosis in infants, medical and surgical aspects.

Friday, October 27

Staff Clinic in Out Patient Department—9.

H. F. Day and associates—General surgery.
Maynard Ladd and associates—Pediatrics.
Malcolm Storer and associates—Gynecology.
W. E. Chenery and H. J. Inglis—Nose and throat.
J. D. Adams and associates—Orthopedic clinic.
T. C. Hill and F. P. Williams—Diseases of the rectum.
A. H. Crosbie and associates—Genito-urinary clinic.
H. F. Perry and associates—Diseases of the skin.
H. F. Perry and associates—2. Accidents and complications in treatment of syphilis; bone syphilis; epithelioma of the skin and its treatment by radium; carbon dioxide snow as a therapeutic agent.

LONG ISLAND HOSPITAL

Wednesday, October 25

John H. Cunningham and associates—9:30. Genito urinary operations.
John H. Cunningham and associates—2. Demonstration of genito-urinary cases.

Friday, October 27

John H. Cunningham and associates—9:30. General surgical operations.

MASSACHUSETTS CHARITABLE EYE AND EAR INFIRMARY

Tuesday, October 24

E. A. Crockett and associates—9. Ear operations.
D. Crosby Greene, H. A. Barnes, and associates—9. Nose and throat operations.
G. S. Derby—9. Eye operations; ward visit; out-patient clinic.
F. H. Verhoeff—9. Lantern slide demonstration of pathological specimens.

Wednesday, October 25

D. H. Walker and assistants—9. Ear operations.
F. E. Garland and assistants—9. Nose and throat operations.
W. B. Lancaster, G. H. Ryder, and G. S. Derby—9. Eye operations; clinical demonstrations; ward visit; out-patient clinic.
A. F. MacMillan—2. Demonstration of X-rays of mastoids and accessory sinuses.
H. P. Cahill—2. Demonstration of normal histological and pathological sections especially of the internal ear.
Staff—2. Demonstration of clinical cases.

Thursday, October 26

W. F. Knowles and assistants—9. Ear operations.
C. B. Faunce, Jr.—9. Nose and throat operations.
F. H. Verhoeff and S. J. McDonald—9. Eye operations; ward visit; out-patient clinic.
H. P. Mosher, H. A. Barnes, and D. C. Greene—2. Demonstrations: End-results of tear-sac operations; end-results of operation in cases of malignant disease of the accessory sinuses; a talk on the use of radium; end-results of cancer of the larynx.
L. E. White—2. End-results of operations on the sphenoidal sinus.
F. E. Garland and V. H. Kazanjian—2. End-results in cases of nasal deformity.

H. P. Mosher, [illegible] Foreign bodies in the bronchi.

[illegible]

Philip Hammond and assistants—9. Ear operations.
H. P. Mosher and [illegible] ations, ward [illegible]
F. H. Verhoeff and W. F. [illegible] results of brain [illegible]
E. A. Crockett—[illegible] End-results in cases of radical mastoid operations.
Philip Hammond, H. P. Mosher and [illegible]
G. L. Tober—2. End-results of operation for sinus thrombosis.

NEW ENGLAND DEACONESS HOSPITAL

[illegible] October 24

D. F. Jones—9. General [illegible]
D. F. Jones—2. Carcinoma of the rectum.
L. S. McKittrick—2. Radium treatment of carcinoma of the rectum.

Wednesday, October 25

F. H. Lahey—9. Thyroid and [illegible]
Elliot P. Joslin—[illegible] Treatment of [illegible] surgical complications.

[illegible]

F. H. Lahey—9. Thyroid and general surgical operations.
F. H. Lahey—2. Clinic on thyroid disease.
B. E. Hamilton—2. Cardiac complications of thyroid disease and diagnosis of thyroid disease.
H. M. Clute—2. Postoperative [illegible] of thyroid disease.
L. F. Sise—2. Anaesthesia [illegible]
Sarah M. Jordan—2. Basal metabolism.

[illegible]

F. H. Lahey—9. Thyroid and general surgical operations.
F. H. Lahey—2. Clinic on thyroid disease.
B. E. Hamilton—2. Cardiac [illegible] disease and diagnosis of thyroid disease.
H. M. Clute—2. Postoperative care and [illegible] of thyroid disease.
L. F. Sise—2. Anaesthesia [illegible]
Sarah M. Jordan—[illegible]

NEW ENGLAND HOSPITAL FOR WOMEN AND CHILDREN

[illegible]

Isabel D. Kerr and Margaret [illegible] throat operations.
Blanche L. Atwood, Olga [illegible] with marked hypertrophy of [illegible] symptoms.

[illegible]

Elizabeth T. Gray and [illegible] Gynecological operation.
Marion Nutt, Lalline [illegible] Obstetrical operation.
Mabel D. Ordway—2. Neurosyphilis.
Blanche Denig and Dr. Wright—2. Medical [illegible]

[illegible]

Letitia D. Adams—9. General surgical operations.
Isabel D. Kerr—9. Nose and throat operations.
Staff—[illegible] Obstetrical [illegible]

[illegible]

[illegible]
Elmer W. Barron and Herman Robbins—9. Pediatrics [illegible] try.

[illegible]

William E. [illegible] A. A. Berry, [illegible] A. [illegible]

[illegible]

W. A. Gobie—9. Extracting.
[illegible] E. Hatch—9. Dental [illegible] ion.
[illegible]

[illegible]

[illegible] atric clinic.

BETH ISRAEL HOSPITAL

[illegible]

[illegible] surgical operations.
Albert Ehrenfried—2. Hereditary deforming chondrodysplasia and certain allied growth distortions [illegible]
S. A. Robins—2. A consideration of the diagnostic points in the interpretation of abdominal X-rays.

[illegible]

E. G. Crabtree—9. Genito-urinary operations.

[illegible]

[illegible] surgical operations.

CAMBRIDGE HOSPITAL

[illegible]

J. W. Sever—9. Orthopedic operations.
A. H. Crosbie—2. Genito-urinary operations.

[illegible]

[illegible] Stevens, and associates—9. General surgical operations.
N. S. Bacon and E. J. Butler—2. Demonstration of [illegible]

[illegible]

F. B. M. Cady—2. Neurological clinic.

[illegible]

COLLIS P. HUNTINGTON MEMORIAL HOSPITAL

Wednesday, October 25

Clinic by Staff—2

R. B. GREENOUGH—The cancer problem.
WILLIAM DUANE—Short wave length X-ray therapy.
HOMER WRIGHT—Free diagnosis service.
WILLIAM BOYD—New contributions of physics to biology.
CHANNING SIMMONS—Radium in cancer of buccal mucosa and tongue.
D. CROSBY GREENE—Radium in carcinoma of jaw and larynx.
GEORGE MINOT—Radium in Hodgkin's disease.
G. G. SMITH—Radium in cancer of the bladder.
G. A. LELAND—Radium in carcinoma of cervix.
ERNEST DALAND—Radium in skin lesions, malignant and benign.
LELAND S. MCKITTRICK—Radium in cancer of rectum.

Friday, October 27

Clinic by Staff—2

R. B. GREENOUGH—The cancer problem.
WILLIAM DUANE—Short wave length X-ray therapy.
HOMER WRIGHT—Free diagnosis service.
WILLIAM BOYD—New contributions of physics to biology.
CHANNING SIMMONS—Radium in cancer of buccal mucosa and tongue.
D. CROSBY GREENE—Radium in carcinoma of jaw and larynx.
GEORGE MINOT—Radium in Hodgkin's disease.
G. G. SMITH—Radium in cancer of the bladder.
G. A. LELAND—Radium in carcinoma of the cervix.
ERNEST DALAND—Radium in skin lesions, malignant and benign.
LELAND S. MCKITTRICK—Radium in cancer of rectum.

EVANGELINE BOOTH HOSPITAL

Tuesday, October 24

A. K. PAINE—9. Prenatal clinic.

Thursday, October 26

A. K. PAINE and STEPHEN RUSHMORE—9. Gynecological operations.

Friday, October 27

A. K. PAINE and STEPHEN RUSHMORE—2. Gynecological operations.

UNITED STATES NAVAL HOSPITAL

Tuesday, October 24

LIEUT. J. W. WHITE—9. Orthopedic operations: Keller operation for hallux valgus; arthrotomy of knee for internal derangement; osteotomy for malunited humerus; repair of finger tendon.

Wednesday, October 25

COMMANDER J. S. WOODWARD—9. General surgical operations.

Thursday, October 26

LIEUT. D. A. HEFFERNAN—9. Eye, ear, nose, and throat operations. Various manifestations of syphilis from an ophthalmological standpoint; enucleations of tonsils; nasal septum corrections. Demonstration of aural cases of acute nasal sinusitis requiring operation.

LIEUT. J. W. WHITE—2. Hallux valgus treated by the Keller operation, end-results and X-rays. Recurrent dislocation of the shoulder treated by the Clairmont-Ehrlich operation, end-results. Finger tendon repair, end-results. Malunion of femora treated by osteotomy, end-results. Generalized osteitis fibrosa treated by conservative means, end-results. Two cord injuries: one a persistent spastic hemiplegia, the other a complete recovery after a Brown-Séquard syndrome at the level of the sixth dorsal vertebra.

HARVARD MEDICAL SCHOOL

Tuesday, October 24

H. P. MOSHER and C. B. FAUNCE, JR.—2. Anatomical demonstrations. (Ear, Nose, and Throat Department.)

Friday, October 27

PROFS. W. B. CANNON, L. J. HENDERSON, C. K. DRINKER, and DRS. ALEXANDER FORBES, J. C. AUB, and A. C. REDFIELD—2. Demonstrations and talks on various physiological subjects of importance in surgery. (Department of Physiology.)

Dates to be Arranged

E. A. CODMAN—Registry of cases of bone sarcoma.

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

Some Errors in the Development of the Thyroid Gland —J. N. J Hartley.

SURGERY, GYNECOLOGY AND OBSTETRICS

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SOME ERRORS IN THE DEVELOPMENT OF THE THYROID GLAND

BY J. N. J. HARTLEY, F.R.C.S., EDINBURGH, SCOTLAND

EMBRYOLOGISTS and comparative anatomists, by their researches on the pharynx, have not only revealed a most fascinating story, but have also done much to elucidate the subject of developmental errors in this region of the body. In particular, light has been thrown on the congenital abnormalities encountered in the thyroid gland, and, prior to detailing certain illustrative cases, it will be well to review very briefly the salient points of the normal evolution of the thyroid and of its associated branchiogenetic organs.

PHYLOGENETIC HISTORY

The thyroid gland is present in all vertebrates and even in the most primitive is composed of closed vesicles containing so-called colloid material. Moreover, throughout the vertebrates, the thyroid takes origin, for the most part if not entirely, from a median anlage which grows down from the ventral wall of the pharynx.

In the lamprey (Figs. 1 and 2), during its long larval stage, the thyroid rudiment remains a bilobed structure with a patent duct leading to the pharynx, and the thyroid only assumes the familiar vesicular characters at the metamorphosis, when the sexual organs become mature. Incidentally, it may be mentioned that, from a comparative study of the fœtal lamprey (ammocœte) and some of the higher intervertebrates, Gaskel (1) was led to believe that the thyroid of vertebrates is the modified utriculus of the ancient palaeostracean. Some would find in this an explanation of the functional relationship known to exist in mammals between the thyroid gland and the genital organs.

Low down in the vertebrate series, various organs are seen to arise from the pharyngeal pouches. From the fifth pouch, a diverticulum develops which becomes the ultimobranchial or postbranchial body and is first to be seen in the fishes (elasmobranch) (2). Still higher in the vertebrate series, namely, in the amphibians, epithelial or parathyroid bodies arising from the third and fourth pouches are added. It is of interest to note that the parathyroids only develop in the larval amphibian when the gills atrophy and the lungs begin to function [illegible]

Fig. 1. Larval lamprey (ammocœte). Transverse section, showing the bilobed thyroid with a patent duct leading to the pharynx.

Fig. 2. Larval lamprey (ammocœte). Longitudinal section passing through a lateral lobe of the thyroid and the patent thyroid duct.

Fig. 3. Thyroid of the tadpole. Longitudinal section through lateral lobe of thyroid.

Fig. 4. Photomicrograph of thyroid of cat, showing the [illegible] nodule and the fourth epithelial body all embedded within thyroid tissue.

[illegible]

Fig. [illegible] (3 months). Showing primitive follicles, some containing a little colloid.

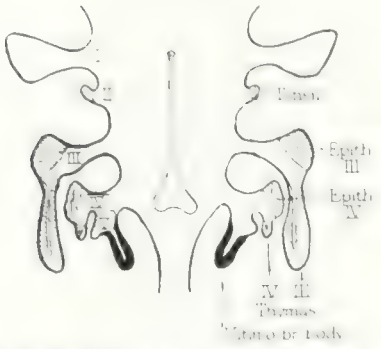

Fig. 7. Schema of the branchiogenetic organs in man. Keibal and Mall.

In reptiles and birds, all these branchiogenetic organs are present but remain separate from the thyroid gland. Even in that primitive mammal, the echidna, so carefully studied by von Maurer (3), the parathyroids and the postbranchial bodies do not come into close relation with the thyroid, though the postbranchial diverticulum gives rise in this animal to an organ composed of vesicles lined by columnar cells.

In certain mammals, the derivatives of the fourth and fifth pouches form at one stage a "complex," consisting of the fourth parathyroid, a thymic rudiment from the fourth pouch, and the postbranchial body. The complex becomes closely united with the lateral lobe of the median thyroid, and, as was first observed by Woelfler in 1880 and subsequently by Stieda in 1881 and Born in 1883, the tissue of the postbranchial body and that of the median thyroid actually fuse. The postbranchial body then became known as the lateral thyroid anlage, and was assumed to participate in the formation of functionating thyroid tissue. It will be readily understood from the above why the fourth epithelial body is usually closely related to the thyroid and why in certain animals, such as the cat, dog, and rabbit (2), it lies embedded in the lateral lobe. In the cat, there is constantly to be found associated with the internal parathyroid, a cyst-like structure, no doubt the remains of the postbranchial body, and often, along with this, is a nodule of thymic tissue (4), (Fig. 4).

Phylogenetically, therefore, the median thyroid was by far the first to appear. Later

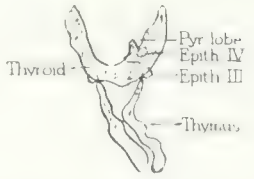

Fig. 8. Branchiogenetic organs. Embryo, 26 millimeters, simplified. (Verdun—from Keibal and Mall.)

arose the postbranchial body and then the parathyroid. In mammals, the fourth parathyroid and the postbranchial bodies have become closely related to the median thyroid. So intimate is the fusion of the postbranchial tissue with the median thyroid that it has led certain observers to believe that in mammals the thyroid is derived not only from the median but also from the so-called lateral thyroid rudiments. It may be observed that this growing together of ductless glands of different embryonic origin is seen likewise to occur in the pituitary and in the suprarenal bodies.

ONTOGENETIC HISTORY

In the human embryo, the median anlage occurs at a very early stage (Broman, 5, 2.5 millimeters) as an evagination from the mesial portion of the ventral wall of the primitive pharynx. The evagination quickly develops into a sac, the orifice of which opens on the summit of the tuberculum impar and then migrates backward to its posterior boundary furrow: the pouch becomes bilobed and travels caudally.

The thyroglossal duct, which for a time has a double lumen, atrophies, and soon the thyroid breaks its connection with the pharynx (7 to 8 millimeters, Broman). The organ then becomes a broad structure composed of irregular cords of cells disposed for the most part transversely (Fig. 5). In a 50-millimeter vertex breech embryo, some of the thyroid cords develop lumina, become beaded, and soon thereafter break up into rudimentary follicles (Fig. 6). Probably for some time after birth, the formation of thyroid continues. Iodine, which is so characteristic of the adult thyroid, is not present until some months after birth.

From the dorsal part of the third branchial pouch, the third epithelial body arises, while,

from the ventral portion, the greater part if not all of the thymus is developed. When the thymus migrates caudally, it carries along with it the third epithelial body, which in man is left eventually in the vicinity of the lower pole of the lateral lobe of the thyroid. It is of interest to note that this parathyroid in the sheep and goat is normally embedded in the thymus (6).

The fourth and fifth pharyngeal pouches, as in lower mammals, give rise to a "complex" consisting of the fourth parathyroid, a thymic rudiment, and the postbranchial body. The fourth parathyroid in man normally remains outside the thyroid gland. The fate of the post branchial body is not easy to decide, and indeed, according to Grosser, Lewis (7), and McMurrick, has not yet been observed through all its phases. As already stated, the researches of Woelfler, Stieda, and Born on certain mammals led to the belief that in man probably a portion of the lateral lobes of the thyroid was derived from the ultimobranchial bodies. No less an authority than Broman (1912) writes that in man the lateral thyroid rudiments develop acini, and, in the third month, can no longer be differentiated from the median thyroid tissue. The prevailing opinion, however, would appear to be that no proof exists of functionating thyroid tissue being derived from any other source than the median pharyngeal rudiment. As will be seen later, there is some clinical evidence which supports this point of view.

The relation between the median thyroid rudiment and the branchiogenetic derivatives is a subject which here needs no further consideration. It may be mentioned, however, that it is one full of interest when dealing with the histogenesis of various types of thyroid neoplasm. Thus, the fœtal adenoma has been said to arise in thyroid rests, whereas the para struma or the *glykogenhaltige* struma was thought by Langhans to be derived from the parathyroids, and the *kleinalveolaere groszellige* struma or the struma postbranchialis of Getzowa has been supposed to take origin from postbranchial body remnants (8, 9). The cases of squamous epithelioma on record may quite well have arisen from some persistent branchiogenetic tissue, though Nicholson (10) has recently shown that chronic inflammation itself may possibly be the means of transforming ordinary thyroid tissue into epithelial prickle cells.

Islet of thyroid tissue, accidentally found in a submental lymph gland removed by Sir James Hodsdon at [illegible]

DEVELOPMENTAL ERRORS

Irregularities in the development of the branchiogenetic organs associated with the thyroid are of little surgical moment. Thymic nodules with accumulation of lymphocytes and the presence of Hassall corpuscles have been observed embedded in the human thyroid, and are supposed to be derived from the fourth branchial body (11). The fourth epithelial body, which is normally within the lateral lobe of the thyroid, in the cat, dog, and other animals, is said rarely to be embedded in thyroid tissue in man.

Congenital abnormalities arising from maldevelopment of the pharyngeal thyroid rudiment are more important, and almost every conceivable type has been described. The thyroid gland may be completely absent, and, in not a few cases, the only vestige of thyroid has been a cyst or an irregular cystic mass in the vicinity of the foramen cæcum [illegible]

Migration of the thyroid caudally may be arrested in any part of its usual course and then gives rise to a true ectopia thyroidis. Most frequently the thyroid then lies in the substance of the tongue or under the lingual mucosa. Less frequently the thyroid is centrally placed below the hyoid bone.

Accessory thyroids are probably far more common than is generally supposed, and are due to the aberrant growth of primary

Fig. 10. Case 1. Miss L. S., 7 years before operation.

thyroid tubules. Though accessory thyroids usually lie in the vicinity of the thyroid gland, they may be present anywhere in the thyroglossal tract, or may wander to more remote regions. As an example of the laterally placed accessory thyroid, one may cite the case recorded by Paton (10). In a girl aged 15, a thyroid growth the size of a walnut lay between the sublingual gland and the mylohyoid muscle. In a case recently operated on by Sir James Hodsdon for epithelioma of the lip, an islet of thyroid tissue was accidentally found in a lymph gland immediately behind the symphysis menti (Fig. 9). The gland was about the size of a pea. So far as could be ascertained, the thyroid gland was normally situated in the neck.

Another group of abnormalities is associated with the thyroglossal duct. As already stated, thyroid tissue may occur anywhere in this tract, and, in a large proportion of cases, such thyroid tissue, at its lower extremity, constitutes the lobus pyramidalis. On the contrary, no thyroid tissue may be formed from the thyroglossal duct itself until it has bifurcated, in which case the isthmus is absent and the lateral lobes are separate, as they normally

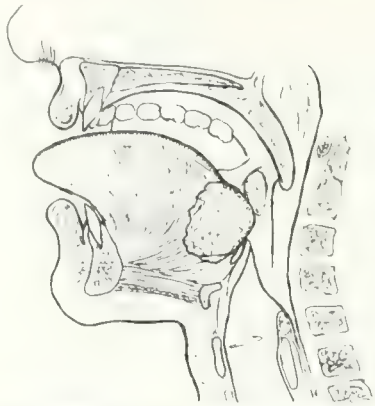

Fig. 11. Diagram to show situation of lingual thyroid in Case 1.

are in birds, reptiles, and some other mammals. Or, one of these bifurcations may atrophy, and then only one lateral lobe is present. Finally, the thyroglossal duct may persist in whole or in part, and is then liable to form cysts, which may or may not erupt and develop into sinuses or fistulæ.

Probably, from the surgical point of view, the most important congenital abnormalities of the thyroid gland are the lingual thyroid and the thyroglossal cysts, and these will be dealt with more fully.

LINGUAL THYROID

Though a relatively rare condition, the cases on record are now sufficiently numerous to allow of generalized statements. Lenormant (14), writing in 1921, was able to refer to 43 cases in the literature. In only three were the patients males. Most frequently the symptoms became troublesome at puberty or during pregnancy. Spencer (12) removed from a baby 3 weeks old a lingual thyroid which gave rise to dyspnœa. Hickman reported that, in a baby only 16 hours old, a lingual thyroid caused death by asphyxiation (15).

Though usually deeply embedded in the root of the tongue, the lingual thyroid generally projects on the dorsum immediately in front of the epiglottis. The mucosa stretched over its surface may be normal and movable, but not infrequently presents dilated venules. Histologically, the tumor has the appearances of normal thyroid or of a parenchymatous or colloid goiter. The symptoms have been

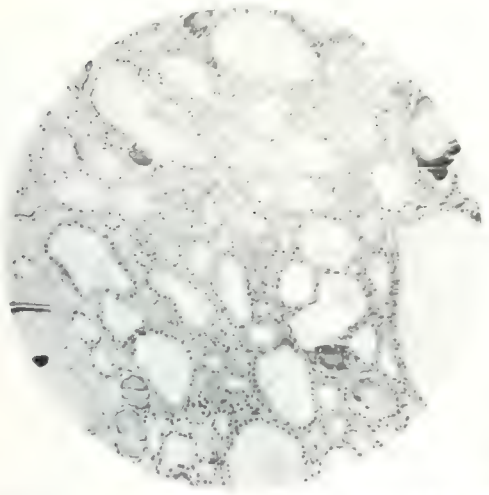

Fig. 12. Photomicrograph of portion of lingual thyroid removed from Miss L. S.

those of difficulty in articulation, difficulty in swallowing, and, in some, interference with respiration. In several, severe hæmorrhage has been the dominant symptom.

Of the various morbid conditions of this region that require to be differentiated, mention may be made of carcinoma, sarcoma, and gumma, all of which are more rapid in their development. Angiomata are more spongy and compressible, whereas the dermoid cyst is, as a rule, more tense.

An important question to decide, as will be shown later, is whether the lingual tumor is a true ectopia thyroidis or merely an accessory thyroid. Though not conclusive, the absence of a palpable isthmus is evidence in favor of the swelling being a true ectopia of the thyroid gland.

Fig. [illegible]. Case I. S. [illegible]

CASE 1. *Lingual thyroid.* Miss L. S., age [illegible], complained of hoarseness, difficulty in swallowing, and, recently, attacks of choking.

History. Since patient can remember, she has been "hoarse," and her friends have always noted that she spoke with a nasal intonation. At puberty, the hoarseness became worse, and at this time she began to cough up glairy sputum, which she thinks came from her throat and not from her chest. She was treated from time to time with gargles, but the hoarseness and cough persisted. At the age of 20, she found occupation as a saleswoman in a store, and this entailed considerable talking, which patient thinks aggravated the cough, the expectoration of mucus, and the hoarseness, and she often found that, in the evenings, the throat was very dry and uncomfortable. For fully 10 years she has experienced difficulty in swallowing. During this time she has had to cut her bread up into small squares free from crust, and to eat her food very slowly. She says that she feels as if what she eats "catches on a ledge" and it is only with an effort that the food can be made to pass the "ledge."

Recently, the hoarseness and difficulty in swallowing have become worse, and she has developed what she describes as "choking attacks." Without any assigned cause, she suddenly feels some obstruction in her throat and for several minutes thereafter can breathe only with great difficulty. It is these alarming attacks of choking sensation which have caused the patient again to seek medical advice.

Physical examination. Patient speaks with a distinct nasal intonation and there is difficulty in articulation. Though the patient is small in stature, her appearance does not suggest any hypothyroidism. Her hair is long, curly, and glossy and she is proud of the fact that it reaches to [illegible] buttocks. The tongue can be protruded with ease, and, when the forsum is displaced with the tongue depressor, the rounded summit of a tumor is just visible on the posterior third of the tongue. The swelling can be readily palpated, and feels about the size and shape of half a large marble. It projects from the pharyngeal surface of the tongue immediately behind the circumvallate papillæ, and extends to near the base of the epiglottis. Its consistence is moderately firm

Fig. 14. Infrahyoid thyroglossal cyst. Photomicrograph of a portion of the cyst wall. Case Miss Jessie M.

rather than fluctuating. The mucosa moves slightly over the swelling, and, when inspected with the laryngoscope, is seen to be smooth, and, apart from the presence of a few dilated venules, appears normal.

On careful examination of the neck, no trace of thyroid isthmus can be felt, the upper tracheal rings being readily palpable to near the episternal notch. No lateral lobes can be detected—but this, of course, does not exclude their presence.

In view of the absence of the thyroid isthmus, the lingual tumor was thought to be an aberrant thyroid rather than a thyroglossal dermoid. As the symptoms had been steadily getting worse and producing distressing choking sensations, surgical intervention was deemed advisable.

Operation, January 14, 1921. Sir Harold Stiles.

Under ether anæsthesia by the intratracheal method, an attempt was made to gain access to the tumor through the mouth. This approach, however, was found inadequate, and the tumor was therefore dealt with through a medial suprahyoid incision. The mylohyoid raphé was divided, and, on separating the geniohyoid and the genioglossus muscles in the mid-line, thyroid tissue was encountered. By means of scissors, the tumor with its covering of lingual mucosa was excised, and this procedure was facilitated by an assistant pressing the pharyngeal portion of the tongue down from above. The wound in the mucous membrane and the various muscle layers were sutured with iodine tannic catgut and the skin closed around a small drainage tube.

Pathological report. The tumor removed was about the size of a large cherry: it was covered on one surface with non-ulcerated mucous membrane. Its cut surface presented areas like thyroid tissue and other areas of lingual muscle. There was no evidence of a capsule.

Histological findings. Showed the appearances of fairly normal thyroid tissue, some acini, however, being dilated and lined by flattened epithelial cells. The lymphoid follicles in the submucosa were well marked.

January 30, 1921. The wound having healed kindly and there being little or no difficulty in swallowing, the patient was allowed to leave the hospital.

On March 8, 1921 (8 weeks after operation), the patient reported. The hoarseness had disappeared and she could swallow quite well. It was noted that the face was a little swollen and there was a little œdema of the feet and ankles. On inquiry, patient stated that her hair was beginning to fall out. She was admitted to a Medical Ward on March 23, 1921, and the basal metabolism rate was found to be −20 per cent.

Her subsequent history is a long story. It is only necessary to state that she developed all the classical signs of myxœdema. The hair became short and brittle, and lost its curl and gloss. She had swelling of the face, swelling of the hands, feet, and ankles. She became apathetic, and lost her previous vigor. She states that she felt drowsy and could only rouse herself to do mental work with an effort. Thyroid therapy was instituted, and the condition became much better, the basal metabolism rate rising to −3 per cent.

An attempt was made, on February 10, 1922, to implant thyroid tissue removed at operation from a patient suffering from hyperplasia of the thyroid gland. It had been found previously, however, that the donor's blood was incompatible with the recipient's serum. Though there was temporary improvement, all the patient's symptoms recurred, and the basal metabolism rate fell to −30 per cent. Thyroid therapy had therefore to be resumed.

Fig. 15. Case 4. Thyroglossal sinus. (H. McL.) Shows orifice of sinus and the tract leading up to hyoid bone.

Though in this case the symptoms were sufficiently urgent to call for surgical intervention, the results of extirpation of the growth certainly were such as to justify the warning issued by Spencer (12) and others. In 1897, Siedowitsch (16) described a case in which myxœdema arose after excision of the lingual tumor, and, in the same year, a similar case was recorded from the clinic of Killian (17). C. H. Mayo (18) states that about one in seven cases operated on have been followed by manifestations of hypothyroidism. It must be urged, therefore, that in those cases where the normally situated thyroid gland cannot be detected, the surgeon should interfere only when marked symptoms arise, and, moreover, only a minimum amount of tissue should be removed.

It will be observed in the above case that the clinical manifestations ensuing were such as to suggest that virtually the whole of the thyroid gland possessed by the patient had been removed, and this opinion was strengthened by the great fall in the basal metabolism rate. Since there is no reason to suppose that in this patient there was any general factor inhibiting the formation of thyroid tissue, one must conclude that, normally, little or no thyroid tissue is formed from the lateral anlage, and this accords with the modern teaching of embryologists. For still further clinical evidence in favor of the thyroid being derived mainly from the median anlage, one may refer to cases on record in which the thyroid was absent or represented by a small nodule in the root of the tongue, and yet dissection revealed in the neck parathyroids and thymus with no vestige of thyroid tissue (12 and 21).

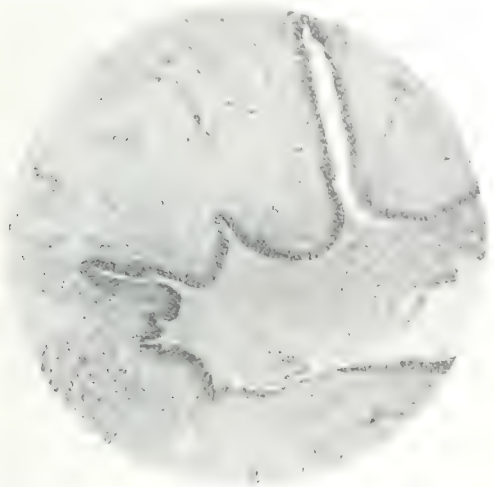

Fig. 17. Photomicrograph at *c*, Figure 16. Tract lined with columnar ciliated epithelium and walls heavily invaded by inflammatory cells.

Fig. 16 (at left). Thyroglossal tract removed by operation in one continuous piece. (Case H. McL.)

Fig. 18 (at right). Composite diagram of thirty serial vertical sections through the middle portion of the hyoid bone. It will be seen that the tract passes in front of the hyoid bone. (Case H. McL.)

It may be pointed out that, in the section (Fig. 17) of the lingual thyroid, there was considerable intervesicular tissue. Though it has been suggested that, in the normally situated thyroid, the intervesicular tissue may be of parathyroid origin, it could scarcely obtain in the lingual thyroid (11).

The following case of "lingual thyroid," hitherto unpublished, which I am able to refer to through the kind permission of Professor von Eiselsberg, is also an illustration of the true ectopia thyroidis.

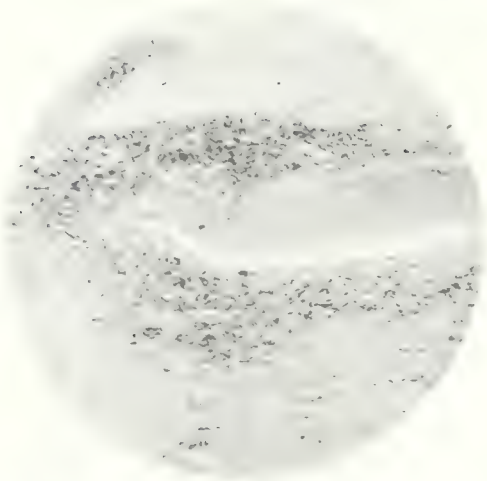

Fig. 13. Photomicrograph. Vertical section of tract in front of hyoid bone at *A*, Figure 1, showing squamous epithelial lining. Case H. McL.

Case 2. Female patient, age 22 years. Two years previously, had an attack of fever with difficulty in swallowing. It was noted by Dr. Kaiser that there was a swelling at the base of the tongue. Five weeks ago, in the region of this swelling, hæmorrhage occurred and this was so severe that the patient fainted.

On examination, no thyroid could be detected in the neck by palpation. In the middle line of the tongue, in the region of the foramen cæcum, a swelling about the size of a nut was palpable. By means of a laryngoscopic mirror, the surface of the tumor was seen to be bluish and semi-transparent, and shining through were several cysts. It was sharply defined from the epiglottis. The tumor was rendered visible without instrumental aid by pulling the tongue forward.

Operation, September 22, 1921. Professor von Eiselsberg.

A T-shaped incision with a horizontal limb above the hyoid bone was made. The muscles were detached for about 2 centimeters from the hyoid bone and the mylohyoid split in the mid-line. On separating these muscles there appeared tumor tissue in the root of the tongue. This was dissected out by blunt dissection, and, in so doing, the pharynx was opened. After arresting hæmorrhage, the divided muscles were sutured and the wound was closed. The tumor was found to be about twice the size of a hazelnut, of a grayish-red color. It looked like thyroid tissue; was moderately firm, and presented no visible line of demarcation between the tumor and the surrounding tissue.

Histologically, the appearance was that of thyroid tissue.

September 29, 1921. The wound had healed and there was no difficulty in swallowing.

THYROGLOSSAL CYSTS AND FISTULÆ

As already mentioned, the thyroglossal duct disappears at a very early stage of fœtal life. Portions, however, especially in the vicinity of the hyoid bone, may persist and give rise to cysts. Those above the hyoid bone are termed "lingual dermoids," and may project into the submental triangle or on the dorsum of the tongue. They are lined by columnar-celled or squamous epithelium. Those cysts arising below the hyoid bone are usually lined by columnar-celled epithelium, frequently ciliated. That stratified squamous epithelium, however, may constitute the wall of infrahyoid cysts, is evidenced by the following case:

Case 3. *Thyroglossal cyst.* Jessie M., age 13 years, complained of swelling in the neck with discomfort in swallowing. *History.* Patient first noticed a small swelling in the middle of the neck about 3 years ago. The swelling gradually grew larger until it reached its present dimensions.

Physical examination. There is a visible swelling in the mid-line of the neck just below the hyoid bone. On palpation, it is found to be about the size of a marble; it is not tender. The skin is quite free, and the swelling can be moved from side to side but feels as if fixed by a pedicle to the middle of the hyoid bone. The swelling is tense and fluctuating.

Nothing abnormal can be detected in the thyroid or in the tongue.

April 29, 1921. Sir Harold Stiles. Under chloroform and ether anæsthesia, a short collar incision was made over the swelling, and, on dividing the deep fascia and retracting the anterior jugular veins and subjacent depressor muscles of the hyoid bone, a cyst was exposed. It was readily shelled out by blunt dissection save for the pedicle which joined it to the hyoid bone and which had to be cut through.

The wound healed *per primam*, and there has been no recurrence.

Pathological report. The cyst was about the size of a marble, thin-walled, and contained a creamy pultaceous substance. A section of the wall showed it to be lined with stratified transitional epithelium, outside of which there was a fibrous coat (Fig. 14).

Thyroglossal cysts most frequently make their appearance during the first two decades, and, though they may remain stationary for years, they tend as a rule to grow larger and are prone to become infected. Not infrequently the swelling is incised in the belief that it is an abscess arising from an infected lymph gland. In other cases the inflamed cyst erupts

Fig. 20. Photomicrograph, transverse section of tract, immediately above hyoid bone at *A*, Figure 16. An islet of thyroid tissue—isolated vesicles containing colloid—is to be seen in the tissue. (Case H. McL.)

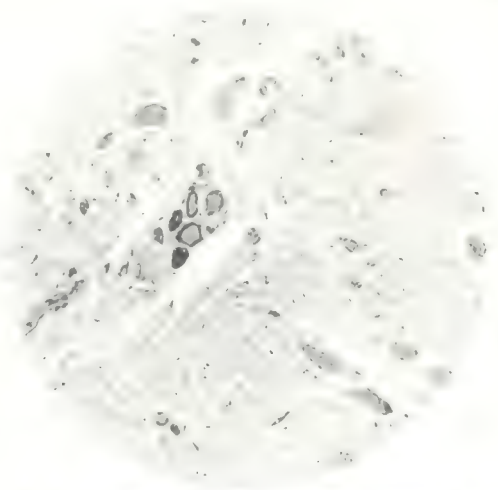

Fig. 21. The islet of thyroid tissue in Figure 20 more highly magnified.

of its own accord. The resulting sinus persists, or, if it closes, opens up again. Such a history is usually forthcoming in the so-called thyroglossal sinus and is illustrated by the following case.

Case 4. *Thyroglossal sinus.* Helen McL., age 17 years, complained of discharging wound in the neck.

History. Since infancy, patient has had a swelling in the mid-line of the neck. At the age of 9 years, the swelling was the diameter of a penny and formed a visible swelling at the level of the thyroid cartilage. After that time the swelling gradually extended downward in the mid-line until it reached almost to the episternal notch. Two and one-half years ago, after an attack of influenza, a reddish blister appeared at the site of the swelling and soon thereafter a quantity of pus was discharged. The opening failed to close and has continued to discharge a mucopurulent fluid.

Physical examination. It will be seen from the photograph (Fig. 15) that a sinus exists a little above the episternal notch, a little to the left of the mid-line. The sinus admits a fine probe, and from the sinus there is a slight mucopurulent discharge. Extending up from the region of the sinus there is a firm, narrow band, readily palpable and extending to the middle of the hyoid bone. No abnormality can be detected in the thyroid or in the root of the tongue.

Operation. January 26, 1922. Sir Harold Stiles. Under intratracheal anæsthesia, a transverse incision was made at the level of the hyoid bone, and a vertical incision down to and encircling the sinus. The flaps of skin and platysma were reflected and the sinus and fibrous tract were dissected up to the hyoid bone, it being found necessary to divide the deep fascia and to retract the depressor muscles of the hyoid bone. It was noted that the tissues in the immediate vicinity of the tract were vascular. As the fibrous band obviously did not end below the hyoid bone, it was thought advisable to resect the middle portion of the hyoid and to search for a tract leading up to the foramen cæcum. The middle portion of the hyoid bone was freed by dividing it with bone forceps on either side. The mylohyoid raphé was split above the hyoid, and, on dissecting between the geniohyoid and the genioglossus muscles, a fibrous band could be traced almost to the foramen cæcum. The whole tract was removed *en masse*. The remaining portions of the hyoid bone were sutured together with iodine tannic catgut and the various muscles brought together, a small drain being left in at the lower angle of the wound.

February 8, 1922. The wound was practically healed and the patient was allowed home.

Pathological report. The specimen removed is shown in Figure 16. It will be seen to consist of the infrahyoid tract, the middle segment of the hyoid bone, and a tract leading up to near the foramen cæcum. A microscopic section of the band immediately above the orifice of the sinus (Fig. 17) demonstrates that the sinus was lined by columnar-celled epithelium, in certain parts several cells deep. Around the epithelial lining there is fibrous tissue infiltrated with inflammatory cells. Serial sections were cut from the middle portion of the hyoid bone, and a composite diagram of 30 of these is shown (Fig. 18). It will be seen that the sinus passes up in front of the hyoid bone and is fused to the anterior aspect of the hyoid by dense scar tissue. Histological sections (Fig. 19) demonstrated that in this region

the tract was lined with squamous epithelium. It is interesting to note that in this vicinity a small islet of thyroid tissue with vesicles of colloid formation was present (Figs. 20 and 21). In the suprahyoid portion the sections revealed nothing but dense fibrous tissue.

It will be observed that in this case the tract passed in front of the hyoid bone. More frequently, the tract has been observed to lie dorsally to the hyoid bone (Gilman, 20, and Marshall) or has been gripped between the two rudiments of the body of the hyoid (18). Experience has shown that after excision of thyroglossal cysts the condition is very liable to recur, presumably owing to epithelial remnants being left in or around the hyoid bone. It is, therefore, advisable, whenever a cyst is found anchored to the hyoid, to remove the middle portion of that bone and to search for a tract leading up to the foramen cæcum. Such a procedure can be carried out with safety, and is generally admitted to be the only means of ensuring a radical cure.

CONCLUSIONS

1. Embryological researches have led to a better comprehension of the various congenital abnormalities encountered in the thyroid gland.

2. A lingual thyroid in many cases is a true ectopia thyroidis and then represents the whole of the acting thyroid tissue of the body.

3. This is clinical confirmation of the modern embryological teaching that the thyroid derives no functionating tissue from the ultimobranchial body.

4. The absence of a palpable isthmus in the pretracheal region is strong evidence of such a lingual swelling being an ectopic and not an accessory thyroid.

5. When a lingual thyroid gives rise to symptoms demanding surgical intervention, a minimal amount of tissue should be removed, and the surgeon should be prepared to adopt thyroid therapy if the clinical symptoms or the basal metabolism rate indicate a state of hypothyroidism.

6. The so-called "infrahyoid" type of thyroglossal cyst not infrequently has an epithelial prolongation upward, either through, behind, or in front of the hyoid bone, and, to ensure non-recurrence, it is advisable, when the pedicle can be traced to this bone, to resect the middle portion and to search for a tract leading to the foramen cæcum.

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THYROTOXIC ADENOMA, WITH REMARKS ON BASAL METABOLISM IN THE DIAGNOSIS OF GOITER[1]

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THE thyroid gland is the dictator of evolution. It is doubtless responsible for the change of amphibians into land animals. A Mexican water-newt breathing through gills when fed on thyroid develops into a terrestrial salamander, with typical mottled skin and aerated through well developed lungs. The size of the gland increases from fishes to larger amphibians and reptiles, is larger still in birds and mammals, reaching the acme of development in man, in whom it is the dominant gland with its effect upon sex, upon intelligence, and upon personality. The active principle of the thyroid secretion is a governor on the metabolic engine. It is the most important of the accessories of the internal combustion engine of the human mechanism, and in the preparation of the food of the body for making its energy it may be likened to the carburetor. Kendell and Plummer at the Mayo Clinic showed that less than one grain of thyroxin doubles the amount of energy as determined by the metabolic rate. On the contrary, the deprivation of thyroxin as in the cretin who is born without a thyroid, renders him apathetic, dwarfed, idiotic, and sphinx-like. When thyroid extract or its principle is administered it is well known that these pitiful little caricatures of humanity wax and grow marvelously.

In the acquired deprivation of the secretion of the thyroid as in myxœdema there is a drying of the body and of the mind, but this in turn disappears under the magic of thyroid administration. Without the thyroid, therefore, there is no growth, no thought, and no reproduction of species.

Exophthalmic goiter, which is dependent upon an excess of the secretion amounting to a poison, speeds up the entire body mechanism and makes the engine race. The exophthalmic is driven by an invisible whip. When the symptoms are full-blown the patient presents the typical expression of the staring countenance and the bulging eye, goiter and tremor. So strong is the heart-throb that the vibration is imparted to the entire body, even the plume on the hat of its victim is agitated.

In addition to the exophthalmic or hyperplastic goiter there are two other clinical varieties: The colloid goiter, the simplest example of which is the goiter of adolescence, which is a work hypertrophy and disappears without treatment or with iodine. If a goiter persists for a good many years, the probabilities are that it is not of the colloid type, but rather an adenoma which is the second variety. It will not disappear of its own accord or under the influence of iodine like the colloid goiter. If the adenoma persists after the age of 25 then an operation will be required. The interesting feature about the adenoma is that if patients continue to carry them, a very considerable percentage will develop hyperthyroidism when they are between 35 and 45. Just what stimulates this apparently innocent adenoma into pathological activity that gives rise to the severe symptoms of hyperthyroidism is not known. In spite of the warning of Kocher and many of the earlier writers on goiter, iodine is often erroneously given to elderly women with long-standing goiter. It will very frequently over-stimulate the gland and produce a hyper-secretion with marked toxic symptoms. It has been referred to as a Basedowified goiter and so definite is the relationship that it is denominated "iodine goiter." The adenomata with hyperthyroidism never develop the prominent exophthalmic eye. We formerly characterized these cases as pseudo-exophthalmic and also non-toxic exophthalmic goiter, but as a matter of fact they are all adenomata and have a tendency to hypertension. They present the tremor and

[1] Read by title at the Tennessee Medical Society at Memphis, April [illegible], 1924.

the tachycardia just as in the exophthalmic and also the loss of weight and strength. Aside from the eye symptoms the main difference is that the exophthalmic goiter seems to expend itself upon the nervous and muscular systems in a very brief time, one or two years; whereas with the adenomata a goiter may have been in existence 14 or 15 years before heart changes manifest themselves as a myocardial degeneration. The patient has carried the goiter so long that when the heart symptoms dominate the clinical picture, goiter is sometimes lost sight of as the etiological factor. Very often the heart muscle will be found in an advanced degree of degeneration. This is not surprising when we consider the time that has elapsed in which this damage could occur as a result of the heart strain from the excessive amount of thyroid secretion. Perhaps the first thing the patient notes wrong in addition to the loss of weight, is that the heart beats faster and harder and that dyspnœa occurs on climbing stairs, and palpitation when in repose. The symptoms come on gradually at first with a little nervousness and the patient is more or less easily excited. There is usually hypertension. This same group of toxic symptoms may be produced by over-feeding thyroid extract, as in "obesity cures," but the symptoms soon disappear when the administration is discontinued.

The exophthalmic goiter comes at a younger age, say 30 to 35, and reaches the maximum of its first curve of severity at or about the end of the first year.

Of the adenomatous goiters about one in five develops the toxic symptoms of hyperthyroidism. With such a definite fixed chance against an individual the question may be asked: "What does it profit a person to carry a goiter of this type around for 15 or 20 years before coming to operation?" Judd found that even after the hyperthyroidism developed an average of 2½ years of symptoms elapsed before operation. Even at that, it is not quite as sad as our exophthalmic cases, because while we get some cases early, as a matter of fact, only about one out of three is sufficiently early to permit of the radical operation at one sitting. The other 66⅔ per cent have been allowed to become so toxic that thyroidectomy cannot be safely performed but they should have a ligation first of one superior thyroid artery and then the other, in order to get a sufficient margin of safety within 2 or 3 months for the removal of the goiter.

The greatest problem in the treatment of goiters is the estimation of the degree of toxicity that exists in a given case. Formerly we relied entirely upon clinical symptoms which gave us many valuable signs of thyroid toxæmia and disturbed metabolism; but we had no accurate index as we have in other diseases, for example, the white blood count in appendicitis and the urinalysis in diabetes. Now we are able to state the degree of toxicity in figures and not only this but we can say how much improvement has been accomplished by our therapeutic measures. We study very carefully the fever chart in infectious diseases. In nephritis the blood-pressure and nitrogen retention and blood urea are estimated. Why should we not follow just as diligently heat production? For in certain diseases we find an enormous heat production without any rise in temperature. This heat production has just as definite a clinical bearing as does body temperature. Body temperature can be determined in a very short time with a thermometer, but heat production can be measured only by a special apparatus.

Although basal metabolism in diagnosis is subject to error, it is probably as reliable as many of our other laboratory measures. Dr. DuBois makes a statement: "But why," says the practitioner, "should I who have seen hundreds of cases, go to all this trouble when I can perfectly well tell from a clinical aspect whether or not the metabolism is increased?"

Such guessing is very common, quite fascinating, and not risky for one's reputation unless the results are checked. On the other hand, those clinicians who have checked up their results in a large number of cases, realize the frequency of their errors, especially in atypical cases, and are not at all surprised if they are not always able to approximate the true figure.

The basal metabolism rate is of great value in hyperthyroidism as it is distinctly a disease of hypermetabolism. It is much more depend-

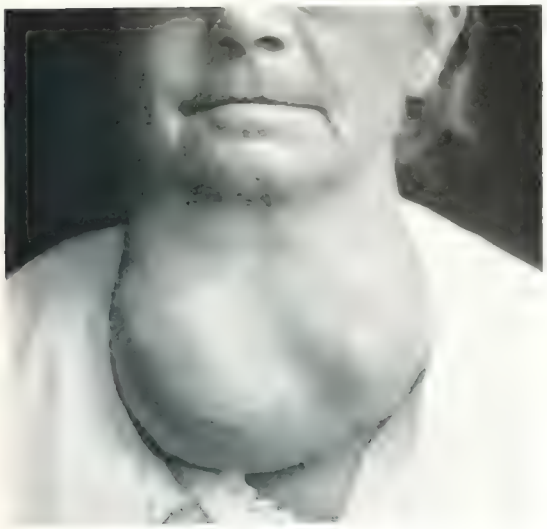

Fig. 1. Multiple symptomless adenoma; patient aged 61. Duration 22 years.

able than the blood sugar curve or the adrenalin test. What advantage does it give us? It helps to separate neurasthenia, cardiac neuroses, effort syndrome, neurologic states which so often simulate hyperthyroidism, from true toxæmia, in that their metabolic rates are within normal limits.

It is of further value in determining a patient's ability to undergo surgical procedures. It will accurately compute varying degrees of severity and will be another aid to the surgeon, in conjunction with other symptoms, in determining whether he should ligate one pole or both poles, or whether partial thyroidectomy should be resorted to in the very beginning. It is of marked value in the determination of the time to proceed with partial thyroidectomy following preliminary pole ligation. In our experience with the metabolic tests, it has changed our methods of handling some of the cases. It is a good plan to estimate the rate every two weeks if possible. A certain patient may pass the maximum gain of improvement before the customary three months' delay after ligation before thyroidectomy.

The first work that was done revealing the importance of metabolism in diseases of the thyroid was performed by Friedrich Muller in 1893. He discovered that his patient lost

[illegible]
140.

in weight, although on a diet greater than normal.

DuBois in a careful observation upon patients with hyperthyroidism was able to show that very severe cases of hyperthyroidism had an increase of 75 or more over the normal average, severe cases 50 over, milder cases or moderate cases under 50.

Metabolism of an individual is variable, due to many factors. There is some variation with sex and also height. Thin people produce more heat than fat and young persons more heat than old people. Sleep, digestion, psychic anxiety, and exercise all influence metabolism. It has been established now that the level of a person's metabolism while at rest and after 12 to 18 hours' starvation is constant, varying only with certain factors such as age and body surface. This is known as the basal metabolism, and has been defined by Lusk as "the minimum of energy compatible with cell life."

Relative to body surface a guinea-pig and an elephant have the same basal metabolism.

By measuring the rate of oxygen intake and multiplying this by the caloric value of a litre of oxygen at the respiratory quotient, the ratio of the quantity of oxygen consumed to the quantity of carbon dioxide eliminated, we determine the patient's basal metabolism rate. When such a machine as Benedict's and others have been perfected, the determination will be just as simple as the blood-pressure reading and the metabolism level is the best functional test of thyroid over-productivity and intensity.

The average metabolic rate in the exophthalmic cases is + 66 per cent according to Boothby and after ligation it goes down to + 50 per cent. Within from 2 to 4 months they improve so much that it comes down to + 42 per cent, and then the final operation is done, followed by a fall to + 19 per cent; but only one-third of the patients return to normal in 2 weeks and one-fourth of them still remain above 30 per cent.

With the adenoma with hyperthyroidism, however, the average metabolic rate has been found to be 35 per cent, and falls after operation to + 7 per cent; in the majority it reaches normal within 2 weeks after the operation.

It is pretty certain that one cannot go wrong in the diagnosis if the basal metabolism rate estimation is taken into consideration together with the other symptoms.

The surgery of mildly toxic goiters is most gratifying. These severe cases test one's knowledge to its capacity and one has to use great care and judgment with practically every expedient to get them to a point where it is possible to do any surgical procedure. Every agent that can possibly be brought into play should be used in nursing these patients back to health. Rest and quiet are helpful. Advantage should be taken of even the slightest improvement. This safe point is very difficult to judge despite all your records, as pulse-rate, gain in strength and weight, as well as lowered metabolic rate. It is difficult to tell what a given myocardium or enfeebled nervous system will bear.

We should be very careful not to bring the surgical treatment of goiter into disrepute. Quite often neurasthenics with slightly enlarged thyroids have been operated on with the thought in mind of curing them of their nervousness, when as a matter of fact, there is no relationship of cause and effect. Fortunately for us, differentiation can now be made by objective tests, such as the basal metabolic rate.

On the other hand, it is not always realized that in the purely medical treatment of toxic goiter we are dealing with an intense intoxication that is being disseminated throughout the entire body in all of the organs and all of the tissues setting up secondary pathological changes that may be very severe and sometimes permanent and often fatal. The toxicity seems to expend itself upon the myocardium, the cerebrum, and the nervous system. The muscular system is very greatly affected as manifested by the extreme weakness and the entire body mechanism is so interfered with that great emaciation often occurs. When the nervous system is involved in an organic way, the functions of the stomach and intestinal canal are so altered that vomiting and diarrhœa are very grave indices of an advancing and threatening toxæmia and are sometimes fatal. The myocardium is perhaps one of the earliest structures to suffer and certainly the most unfortunate. The "goiter heart" of the old authors is well known. With the genuine toxic type it is accentuated sometimes to the nth power. Is it not better to anticipate this severe complication, in all adenomata, by early operation? Kocher called attention to the danger of malignant degeneration of goiters in patients over 35.

Cerebral irritation is often manifested by peculiarities and vagaries that are quite unlike the usual quiet calm of the individual. The disposition often becomes irritable. We have seen real mania as a terminal and fatal symptom. The first surgical consultation was years too late. In toxic goiter, surgery is prophylactic and should be instituted at the earliest possible moment in order to curtail the disastrous effect upon the various organs, structures, and functions of the body.

Inasmuch as the over-production of the thyroid secretion, no matter what its intricate

and complex cause may be, is the real point in the production of the toxæmia, our efforts should be directed to diminish the amount of secretion. Rest in bed and the tonic effect of cold over the præcordia are the simplest measures and the best drug to control the heart is digitalis. These measures, however, are temporary and our dependence must be placed in some surgical measure permanently to reduce the amount of thyroid secretion. In the ligation of the two poles of the thyroid, we practically cut down its blood supply, and therefore its resulting capacity for production of thyroid juice is practically one-half. In the grave cases, however, even a ligation under local anæsthesia has its dangers. In our earlier work, before surgeons were able to protect the patient by careful methods of preparation, perfected technique, and an acquired judgment as to the time to intervene, the death rate from this simple procedure was over 3 per cent; now it should be reduced almost to the minimum by the nicety of judgment and the exquisite care that is utilized in the handling of these cases. It becomes a game in which our results are measured by the skill and judgment of the operator. The goal is to deliver each patient in a safe manner from his excessive overproduction. Mayo, with his enormous experience, judgment, and skill, has been able to approach perfection in the management of these cases; and Crile, by his commanding wizardry in obtaining the object of the surgical endeavor has placed the surgical treatment of toxic goiter among the scientific triumphs of the age. When once the diagnosis of toxic goiter is made, what does it profit a patient to delay? Is it not wiser, as in appendicitis, when the diagnosis is made, to remove easily and quickly and for all time the offending organ and to forestall all complications and disasters? This is a simple rule of surgery that is applicable to this murderous disease.

We have used X-ray to a certain extent to prepare patients for an operation. It has about the same effect as a ligation and can be sometimes employed in cases that are almost too sick for ligation. We have seen but one permanent cure following the use of the X-ray without operation. It is impossible to estimate accurately the amount of radiation it will take to destroy sufficient of the cellular elements to stop the hyperthyroidism. If we give a little bit too much we get a myxœdema, if we give too little we do not relieve the patient. It is at best a *modus vivendi* remedy and great care should be exercised in its indiscriminate use in such an important structure as the thyroid gland. The same may be said of radium which is even more powerful and quite difficult to regulate in its dosage and effect, which effect if an over-dosage is very difficult or impossible to recall.

It must be remembered that an operation is not an emergency measure in toxic or exophthalmic goiter. The sicker the patient the more dangerous the operation. Preliminary preparation, if judiciously carried out, will allow ligation and so improve the patient that at the end of two or three months, the lost body weight will have been regained and the basal metabolism rate will have been reduced to a safe limit, so that the complete operation may be done. Thus, preliminary ligation and careful preparation take the desperate cases out of the death class.

The utilization of the perfected method enunciated by Crile and the principles which he has elaborated are most interesting. The combined local and light gas-oxygen anæsthesia, really amounting to an analgesia, in which the patients are barely asleep and really can be recalled in a moment, as the anæsthetist carries on a quiet conversation in subdued tones with them, is ideal. The rapidity of operation and the avoidance of unnecessary trauma as a result of great delicacy and swiftness of touch are the desiderata.

The hardest thing to learn is not to do too much. A most excellent rule, therefore, is to stop the operation at any moment at which any fear is entertained as to the outcome. We will all be saved very mortifying experiences if this simple precaution is taken. It isn't because we don't know of the danger that we are in, but because we think we can get by. When in doubt, stop. The temporary packing open of the wound with gauze, as advocated by Crile, is really a life-saving measure in those desperate cases where the

prolongation may be the last or fatal straw. The wound can be easily and quickly closed that same day and if necessary the next day without any difficulty and with as little scar as one could desire.

The after-treatment in these cases is a question of months instead of weeks, and years instead of months. The mere removal of the cause of the poisoning does not repair the damage done to the vital organs and functions. He is the best surgeon who avails himself of the best medical care and physiologic management in the after management of these grave cases. In the technique one should always bear in mind that it is only essential to leave a small portion of the exophthalmic gland, but that portion should always be over the trachea along the posterior capsule. The trachea should never be bare and should not be tied because of the trouble with the phonation and swallowing and the likelihood of the development of bronchopneumonia. Furthermore, in the closure of a wide defect after bilateral resection, one could easily draw up the tissues too tightly, so that the larynx is interfered with; and in one such case our patient was only rescued from the impending suffocation by a tracheotomy on the table. This is bad surgery and could be avoided by proper care. Large lateral lobes and substernal goiters should not be rudely rolled out on the neck as they may quickly cause cyanosis. It is rather better to sever the gland at the isthmus as advocated by Balfour and then from its superior attachment and pull it up, as advised by Crile. To push it up takes the chance of rupturing delicate blood vessels and deluging the field with blood.

In view of the advanced, widespread terminal pathology which many goiter cases have in association, the severe reaction which patients manifest to all stimuli, surgical and psychic, the surgeon should be deeply imbued with the admonition, "Be ye wise as serpents; harmless as doves."

FRACTURES OF THE TIBIAL SPINE COMBINED WITH FRACTURES OF THE TUBEROSITIES OF THE TIBIA[1]

By JAMES WARREN SEVER, M.D., Boston

IT is stated in practically all the literature that fracture of the tibial spine is a rare type of fracture. In a recent discussion Sir Robert Jones (1) states that he has seen many cases, and believes that many have been overlooked in the past. The following cases have been discovered recently in a number of old X-ray plates about to be thrown away. They are of interest not only on account of the nature and the severity of the fracture as seen in the X-ray, but they are of interest as well in the character of the results in the cases which could be traced. These results are rather at variance with the statements usually made in regard to the prognosis in these fractures.

The disability which is supposed to follow these fractures, results from one of two causes, or both together; namely, rupture of one or both crucial ligaments, or bony blocking of the knee to full extension from a fragment. Great violence is necessary to cause rupture of both crucial ligaments, and may result only when there has been a complete dislocation in any direction of the knee joint.

Following rupture of one or both of the crucials, the knee is most unstable, and the tibia can be displaced forward in full extension if the anterior crucial is torn, and can be displaced backward with the knee flexed if the posterior crucial ligament is torn. Good function with only moderate disability is obtained in these cases following prolonged fixation in full extension. The ligament itself may be ruptured or its insertion with pieces of bone attached may be wholly torn loose.

In none of the cases which I have seen has there been any limitation of extension or flexion of the knee, and no undue mobility

[1] From the Orthopedic Clinic of the Cambridge Hospital, Cambridge, Massachusetts.

Fig. 1. Case 1. M. S. Note line of fracture into joint through external tuberosity of tibia producing knock knee. Tibial spine apparently intact. Roentgenogram taken November 11, 1913.

Fig. 2. Case 1. Showing condition of patient December, 1921, seven and one-half years after injury. Note sinking in of line of fracture with cupping of external tuberosity of tibia.

except in the lateral direction. This increased lateral mobility occurred when the leg was fully extended, and in no case, even in weight bearing, contributed to the discomfort of the patient. It has been stated by both Jones (loc. cit.) and Kurlander (2) that the most constant sign of fracture of the spine of the tibia is an obstruction to full extension of the leg. This has not been true in this series, which may, however, be an exception to the usual rule.

Jones and Smith (3) offer the following classification of injuries of this type: (1) avulsion of the tibial spine or its internal tubercle, (2) fracture of the external tubercle of the spine, (3) injury to the spine combined with fracture of a tuberosity of the tibia.

1. Avulsion of the tibial spine or its internal tubercle is produced by violent tension on the crucial ligament, caused by inward rotation of the thigh and abduction of the lower leg.

2. Fracture of the external tubercle of the spine, was first described by Jones and Smith, and they report three cases—probably not connected with injury to the crucial ligament, and possibly caused by the sharp inner margin of the external condyle of the femur shearing off the external spine from behind, either by the femur being forced forward or the tibia being driven backward, with the lower leg outwardly rotated.

3. Injuries to the spine combined with fracture of one of the tibial tuberosities, usually the result of direct and severe violence.

S. Fosdick Jones (4) reports a case of fracture of the tibial spine due to direct violence, the end-result being a very nearly perfect knee following long immobilization. He also reviews the important literature on the subject.

Fowler (5) reports a case of fracture of the external tuberosity of the tibia associated with an external dislocation of the knee.

Fig. 3. Case 2. Note fracture of external tuberosity of tibia, and also of internal spine of tibia.

Fig. 4. Case 3. Note line of fracture transversely through head of tibia—internal tuberosity.

following a fall of about 3½ feet. The patient landed on his feet and then fell to the ground. The patient died 10 days later of pneumonia and at autopsy the knee joint showed the following condition: "The outer half of the head of the tibia was the seat of a comminuted fracture. The external lateral ligament was torn across, the anterior completely torn, the internal only partially ruptured. The anterior crucial ligament was torn and the posterior was intact."

Case 1. M. S. age 26, female. See roentgenograms, Figures 1 and 2. Patient was knocked down by an automobile on October 20, 1915, and her right knee injured. She was taken to a hospital where her knee was immobilized. At that time the examination failed to show crepitus. The knee was swollen and tender, but could be flexed and extended fully.

An X-ray examination showed that the external tuberosity of the tibia had been fractured obliquely into the joint. The break apparently did not extend all the way through the tuberosity to the back of the bone, but involved apparently about the anterior two-thirds of the articular surface, which was displaced downward and outward. The line of fracture started very close to the spine of the tibia, and ran downward and outward. There was no apparent fracture of the spine itself.

I saw her first on December 11, 1915, and a week later applied a light plaster cast, the front of which was later removed so as to massage the leg and allow active and passive motion. The patient had an uninterrupted convalescence. The result at the time of her discharge was not a perfect knee, however, for she was left with a moderate degree of knock knee and considerable lateral mobility of the knee joint in an outward direction, combined with free outward rotation of the tibia. The question of how much this mechanical disability, from joint relaxation, can be controlled by muscular action is to be answered only by time and use. I doubt very much whether she will be very comfortable without some support under the inner edge of her shoe, so as to prevent, as much as possible, knock knee or subsequent joint strain. At present, December 14, 1921, she is walking on the leg without trouble, but stands with slight knock knee. There is normal motion in flexion and extension; marked lateral mobility in outward direction. Functionally a very good knee with no thickening and no fluid.

Case 2. N. B., age 59, stevedore. Accident July, 1913, and patient fell about 4 feet landing on right knee. He was taken to a hospital where he had a cast applied which he wore about 2 months. Soon after taking off the cast, he had a caliper splint on

Fig. 5. Case 4. Note the complete fracture through the tuberosities of the tibia, and the head of fibula. Lateral view.

Fig. 6. Case 4. Anteroposterior view. Note comminuted fracture of head of tibia and fibula, extending into knee joint, involving external spine of tibia.

his leg for about 2 months without relief. He complained, when I saw him about 2½ years after the accident, of his inability to walk any distance without the use of a crutch or cane. Also that his leg was weak, painful, and easily tired. He has been unable to go back to his work as a stevedore since the accident.

Examination of the right knee showed that there was very little limitation of motion in flexion and none in extension. There was a moderate degree of knock knee on the right and more lateral mobility, particularly in abduction, than there should be. There was slight bony thickening about the external tuberosity of the tibia. The roentgenogram of the right knee joint showed that the injury had caused a fracture through the external tuberosity of the head of the tibia, extending into the joint, and causing a moderate downward and outward displacement and slope of the external articular surface of the knee joint. The spine of the tibia had apparently been involved also and presented some evidence of callous formation and displacement. See roentgenogram, Figure 3. The fracture apparently does not go completely through the articular surface but seemingly has taken off the anterior two-thirds back to the line of the fibula and extends inward to the inner edge of the spine of the tibia.

This change in the weight-bearing surface of the knee joint is the direct cause of the knock knee and joint strain. Whether an operation planned to restore the level of the joint surfaces and repair the crucial ligaments could be done without doing too much damage to the joint and possibly without any real benefit, I don't know. I imagine that considerable of the disability could be met and prevented by a Thomas sole and heel, and possibly quite as much accomplished as by an operation, except in some severe cases.

It is of interest to note that in this second case there has been and is no limitation of full extension of the leg of the thigh, which

Fig. 3. Case 3. Note comminuted fracture of spine of tibia, left, especially involving the external spine and external articular surface of the head of the tibia.

might be expected from the X-ray findings, showing such a marked change and callous formation in the spine of the tibia.

No operation was done on either of these cases, and they both have knock knees and strained joints. Both conditions, however, can probably be easily controlled by balancing the foot and leg in proper weight-bearing lines, without much difficulty.

Case 3. A. R., age 45. This man fell a distance of about 60 feet, some 6 months ago. He was taken to a hospital where he stayed only about 2 weeks. There it was found that he had sustained a Potts fracture of the right ankle, a contusion of the right knee, a fracture of the head of the tibia on the left, and a contusion of the left shoulder. He wore a ham splint only on the left leg for about a month, since which time he has been walking about on that leg.

The leg now presents the following condition: There is some thickening about the internal tuberosity of the tibia with a distinct ridge to be felt where apparently the upper fragment had slipped forward slightly. Some of the swelling is undoubtedly due to callous formation. The patella is movable. There is no joint thickening and the leg can be fully extended, but can be flexed only to about a right angle. He can stand and walk well, and there is no knock knee or bow leg. Functionally he seems to have a pretty good leg with prospects of a better one.

This fracture was probably caused by direct violence, either by falling directly on the knee, or more likely by being struck by a timber or steel floor beam during the process of the fall. He has a perfect result from his Potts fracture on the other leg.

Roentgenogram (Fig. 4) shows on femur, in internal aspect of internal condyle a small bony exostosis. It shows also a transverse line of fracture through the head of the tibia beginning at the inner edge of the internal tuberosity and running downward and outward to the middle line of the shaft. There is a slight overlapping of the edges of the fragments. The spine of the tibia appears normal. There is also a fracture of a portion of the head of the fibula.

Case 4. E. B. This woman fell down stairs September, 1913, and injured her left knee. She was taken to a hospital and X-rayed following which she wore a plaster cast 5 weeks. She then began to go about on crutches, and began to bear weight on the leg with a cane in January, 1914. The cast was applied with the leg in full extension, December, 1921. Since the accident she says that the leg gets tired after being on it all day, but otherwise does not bother her. She stands with a moderate knock knee. There is a knock knee evident with the leg fully extended without weight bearing; considerable lateral mobility in the outward direction; no forward or backward mobility of the tibia or the femur in flexion or extension; and some bony thickening about the head of the tibia. She considers that she has a perfect result. (Figs. 5 and 6.)

Case 5. A motorman, age 39, hurt his left knee in a playful scrap with another man on May 21, 1916. His left foot caught in a rail with a high flange on it, and he felt something snap in his knee as he turned. He was unable to bear weight on his leg for 4 weeks. I saw him at the end of that time. His knee was then swollen, full of fluid, and painful in attempted motion, especially in lateral directions. His leg was put in a splint. He was given baking and massage. He was seen September 14, 1916, at which time, about 4 months after the accident, he had normal flexion and extension of the leg, and was back at work. He was last seen December 14, 1921. He stated he had had no trouble for 2 years with the leg. He was working steadily as a motorman. The knee could be flexed and extended fully without pain or discomfort. There was no marked lateral mobility. The result was a perfect functional knee. There was no knock knee. The X-ray showed a fracture of the spine of the tibia, especially the external one. (See Fig. 7.)

Case 6. A. L., age 47. Patient fell down stairs May 7, 1913, and injured the right knee. Roentgenograms taken May 9, 1913, showed a fracture of the internal tuberosity of the head of the

Fig. 8. Case 6. Lateral view. Note fracture just below tuberosities of tibia.

Fig. 9. Case 6. Anteroposterior view. Note line of fracture extending down through head of tibia, a comminuted fracture of spine of tibia.

tibia as well as a fracture of both the tibial spines. She was in a plaster cast until July 18, 1913, following which she wore a bandage. On August 18, 1913, the note was made that the knee showed great limitation of motion, and was painful, but that she was walking without crutches. (See Figs. 8 and 9.)

Patient seen again in January, 1922, about 9 years after the accident. Perfect motion in knee joint, no disability, no knock knee, no joint relaxation, and perfect function. X ray showed practically a normal knee joint with a little irregularity of the joint surfaces, and the patient stated that her knee did not bother her in any way whatsoever and had not for several years.

Case 7. N. D. This man, age 42, was injured June 20, 1921, by being run over by a wagon. The wheel passed over his right knee, causing a comminuted fracture of the end of the femur and head of the tibia, as well as amputating two toes on his left foot.

I saw him first on September 13, 1921, at which time he had a moderate amount of motion in the knee with considerable lateral mobility. He was last seen December 21, 1921. He bends the knee to a right angle. He has full extension, with slight tendency to hyperextension. The postcrucial ligament is probably intact as there is no motion of the tibia forward or backward with knee flexed. With knee extended the tibia slides forward and backward on the femur as a result of the apparent rupture of the anterior crucial ligament. The tibia rotates freely outward, with only a slight lateral mobility. The weight-bearing position is excellent. Patient walks with slight hyperextension of knee. The X-rays show the fracture into the knee joint with injury to the internal tubercle of the spine and fracture of the head of the tibia. See Fig. 9.

Case 8. C. H., age 56. He stated that he was injured on November [illegible], 1910, when he jumped from a cart and broke his right leg. He has been walking around on the leg using the leg as much as he can, and on account of pain and limitation of motion he is unable to go back to work at his previous occupation. On May 22, 1919, the right leg showed a moderate degree of knock knee, considerable relaxation of the knee joint, and a slight permanent flexion of about five degrees. The leg can be

Fig. 10. Case 7. Note comminuted fracture of head of tibia with fracture of internal spine of tibia, and a loose fragment.

Fig. 11. Case 8. Note transverse fracture through head of tibia and fracture at base of spines of tibia; note dropping of external articular surface of tibia.

flexed to 90 degrees and fully extended. He still had moderate knock knee and slight joint relaxation. There is no appreciable shortening. He complains of pain and weakness in the leg.

A roentgenogram which I took showed that he had had a rather unusual fracture, namely, a transverse one through the tuberosities of the tibia as well as a fracture of the internal spine of the tibia at its base, with some dropping down of the inner tuberosity, which has resulted in knock knee. He has some trouble going up and down stairs, and in getting on and off a team. (See Fig. 11.)

These cases represent a fairly severe type of injury to the knee joint. The cases followed show very good ultimate function. The treatment has been non-operative; generally long fixation in extension, followed by massage and baking, and passive and active motion.

Early manipulation to restore joint surfaces to normal planes might have been of use but was not done. No operation to restore tibial spines or repair torn crucials has been done in this series, although the operation has been done by Pringle (6) and S. Alwyn Smith (7). The operation should be reserved for those cases which do not obtain full and free extension of the knee joint, combined with pain and disability. The usual method of approach is the one advocated by Sir Robert Jones, of a vertical incision through the patella, which gives one a good view of the anterior crucial ligament and spine of the tibia. By this procedure any bony mass may be removed and the leg extended.

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TUMORS OF THE TESTICLE.

With Analysis of One Hundred Original Cases

By CHESTER O. TANNER, M.S., M.D., [illegible]

FROM early historical times to the present day, diseases of the testicle have received an undue amount of attention in medical literature. The exposed position of these organs, the ease with which they may be investigated by surgical operation, and the early manifestations which any enlargements present, all tend to bring prominently to the attention of physicians definite data for diagnosis and treatment of the various pathological conditions which may involve these organs.

In respect to the inflammatory enlargements, our knowledge is fairly definite, means of diagnosis clearly determined, and methods of treatment placed on a rational and well standardized basis. Neoplasms of the testis, however, present an altogether different picture. Not only is their diagnosis difficult and made unreasonably late in the disease, but also the procedures in regard to treatment are still followed oftentimes with a blind disregard of a knowledge of the fundamental pathology and mode of extension of these tumors. Even pathologists, in all the years past in which these new-growths have been studied and classified, are by no means agreed as to their ontology, classification, or proper interpretation.

The result of this confusion is that, as a rule, the patient's welfare is being jeopardized while the surgeon, for the time being, is content with simple orchidectomy and the pathologist with some sort of a diagnosis of a malignant tumor of the testicle.

Malignant disease of any organ or tissue of the body always presents so varied a group of growth processes that strict classification and clear-cut prognosis is often difficult or impossible.

In tumors of the testicle not only are found the usual grounds for variability, but in addition we are dealing with a gland the function of which is peculiarly adapted to the production of germ cells. Thus the theoretical classification of tumors of these organs embodies the widest possible range of new pathological formations. Strangely enough that other cell gland, the ovary, whose function is often given a place analogous to that of the testicle, does not present in any closely comparable degree similar problems in tumor ontogenesis.

In general it may be confidently affirmed that tumors of the ovary are more often benign and, even when malignant, of a lesser degree of malignancy than tumors of the testicle.

With these points in mind, it was thought that the collecting and reviewing of a considerable number of these tumors,[2] together with their follow-up histories, might help in settling some of the problems of this important subject. Approximately 50 cases were obtained at the Mayo clinic, 30 cases from the various hospitals in Minnesota and 20 cases from Chicago hospitals. In other words, 100 tumors were examined. Each tumor was first carefully examined grossly and then sectioned so that numerous microscopic sections could be obtained from various areas. In this way all portions of the tumor were examined. Follow-up letters were written to all patients or their relatives when possible, and questions asked as to recurrence following operation, subsequent treatment, present state of health, time of death, etc.

The embryology and anatomy of the testicle is omitted from this abstract, also the history and résumé of the literature.

It should be borne in mind that the primary lymph nodes draining the testes are those members of the lumbar group in front of and by the sides of the aorta and vena cava below the level of the renal veins.

Tumors of the testicle have been very difficult to classify. Confusion has existed in the

[1] Abstract of thesis submitted to the Faculty of the University of Minnesota, Graduate School, [illegible] for the degree of Master of Science in Surgery. Read [illegible]

[2] The author personally examined as to gross and microscopic study, [illegible]

classification of those tumors since the earliest findings were recorded. As an example of this is the following classification taken from an extensive article on this subject:

1. Myxosarcoma,
2. Cystosarcoma,
3. Carcinoma,
4. Mixed tumor,
5. Sarcoma,
6. Medullary carcinoma,
7. Cystoma,
8. Cystoid disease,
9. Teratoma with malignant degeneration,
10. Dermoids.

Recently Maitland, Hertzler, and others have concurred with Ewing in the belief that all of these tumors are really teratomata and that the so-called pure tumors merely represent a one-sided development of a heterogeneous growth.

Of the 101 tumors studied in this series, 97 were malignant and 4 were benign (dermoids). Thirty-five were of the mixed or embryoid type, while 62 were of the soft, cellular, medullary type. This latter type of tumor develops in the interior of the organ. The tunica albuginea is uniformly distended by a solid homogeneous tumor without cysts. The color is rose yellow and the consistency is somewhat more firm than that of normal testicular tissue. On cut sections are often seen degenerated zones, whitish in color, soft, and with the appearance of tuberculosis. Areas of hæmorrhage are frequent. On the other hand, before opening the tunica vaginalis this type of tumor looks like an enlarged testicle. The microscopic picture of this type of tumor is quite characteristic. It is made up of large, round, and polyhedral cells possessing voluminous nuclei and a much reduced protoplasm.

The next most common variety, the so-called mixed or embryoid type contains divers tissues—cartilage, muscle, epithelium with or without cyst formation, nerve tissue and sometimes bone. Cartilaginous tissue is an element very common in this tumor. Out of 35 tumors, cartilage was found in 17 of this series.

Formerly sarcoma of the testicle was the diagnosis usually made, in fact, nearly every testicular tumor was called sarcoma by the surgeon. It is really a very rare tumor if it exists at all. The typical testicular dermoid is composed of a cyst containing hair and sebaceous material, often teeth, and is lined by epidermis. This type of tumor is very rare. In all the pathological museums attached to the medical schools of London, there are only three specimens of testicular dermoids containing hair. The series reported in this paper contains four.

A further variety of tumor which is still much debated is that of the so-called chorio-epithelioma of the testis. Although such tumor undoubtedly exists, none was found in this series.

In the following suggested classification the two types which are italicized are the only ones of clinical importance, while the others are included merely to give a place to those rare tumors which undoubtedly do occur.

A. Malignant:
   1. "*Carcinomatous*"—large cell, large nucleus type undoubtedly closely related to
   2. "*Mixed tumor type*"
      a. Tumors containing cartilage, cysts, glands, etc.,
      b. Ordinary glandular structure tumors,
      c. Chorio-epithelioma,

B. Benign:
   1. "Dermoid."
   2. "Epithelial."
      a. Adenoma of the seminal tubules as described by Pock and Chevassu.
   3. "Mesoblastic."
      a. Interstitial cell tumors,
      b. Fibroma,
      c. Lipoma, myxoma

ETIOLOGY

New-growth of the testicle is a very rare disease. Approximately 600 cases have been reported. The disease occurs about once in 2000 male hospital admissions. Out of approximately 300,000 admissions to the Mayo clinics, including both males and females, about 50 cases were found. In the London hospital, records for a period of 20 years re-

ferred to 65 cases of this disease. During this time 110,000 male patients had been admitted to this hospital.

LOCATION

New-growths of the testicle are practically always unilateral. The bilateral malignant growths recorded in the literature are extremely rare and always secondary to tumor elsewhere.

HEREDITY

Heredity seems to be of little if any importance in this disease.

TRAUMA

Injury has often been named as an etiological factor. In this series 22 patients out of 100 gave a definite history of injury to the testicle.

AGE

In this series the ages were found as follows:

Less than 5 years	1
Between 6 and 17 years	—
Between 18 and 29 years	1
Between 30 and 39 years	32
Between 40 and 49 years	12
Between 50 and 75 years	12

These figures confirm the general opinion that practically all cases occur during the period of greatest sexual activity.

RELATIONSHIP TO UNDESCENDED TESTICLE

There is a prevalent idea among surgeons in general that a testis retained within the abdominal cavity is very prone to become malignant and should be removed. After an exhaustive review of the literature, together with a study of my own series, it seems logical to conclude that the abdominally situated testicle is relatively immune to malignant changes, whereas the testicle lying in the inguinal canal is more apt to become malignant than that in the scrotum.

DIAGNOSIS AND SYMPTOMS

Usually the patient consults a doctor on account of a swelling in one side of the scrotum. Nearly always this swelling has been noticed for several months and has gradually increased in size. These tumors are sometimes entirely without pain, sometimes sensitive, and occasionally very painful. In this series there was a definite history of pain in the testicle during some period of the disease in 52 cases, or 52 per cent. The tumors are particularly heavy and of firm consistency. In most cases the cord is much larger than that of the opposite side, due to the necessity of a greater blood supply to the part. But this is also true in syphilitic testicle and hæmatocele. The scrotum contains an ovoid tumor the size of a hen's egg or larger, which is smooth or slightly furrowed and firm, elastic in consistency, and does not transmit light. It is necessary to bear in mind that hydrocele often accompanies malignancy of the testicle. A great many patients come to the surgeon with the history that the family physician has repeatedly aspirated the scrotal sac for hydrocele.

Four diagnoses must be considered: neoplasm, syphilis, hæmatocele, and tuberculosis. In tuberculosis one is usually aided by the family or personal history. The growth usually increases in size quite rapidly, usually causes pain and sometimes fever. The growth first appears in the epididymis and extends along the vas as small nodules. Later on the testicle is involved and often sinuses break through the skin surface. Tuberculosis is usually only one manifestation of a generalized genital tuberculosis. The prostate and seminal vesicles may show signs of involvement and tubercule bacilli may be found in the urine.

Hæmatocele is relatively easy to distinguish. But it cannot be distinguished by its form, consistency, sensibility, or state of the cord. Two main signs are useful in differential diagnosis: (1) the palpation of the tunica vaginalis and (2) especially the palpation of the epididymis. If, on the surface of a scrotal tumor, one palpates the tunica vaginalis, it is certain that he is not dealing with an hæmatocele. It is also impossible in hæmatocele to feel the epididymis between the fingers, because one finds it hidden in the cavity of the hæmatocele. Exploratory puncture should not be done in such cases. Frequently a neoplasm is aspirated, blood is obtained, and a diagnosis of hæmatocele made. In this way harm is done in that proper treatment is delayed by the faulty diagnosis

and the more early spreading of the neoplasm becomes possible. A biopsy is warranted in all cases of doubt.

PROGNOSIS

Few neoplasms have a worse prognosis than those of the testicle. Out of 600 cases collected from the literature and which were operated upon, 465 were followed. Of these, 377, or 81 per cent, were dead, while only 25, or 5½ per cent, were found to be living and well 4 years or more after operation.

In regard to prognosis these tumors may be divided into three classes: (1) very malignant (mixed tumor type); (2) malignant—to a lesser degree (carcinomatous type); (3) truly benign or reserved prognosis (dermoids, etc.).

The mixed tumor types are generally very malignant and change rapidly in structure. This is contrary to the behavior of mixed tumors found in the parotid, submaxillary glands, and elsewhere. Of the 22 mixed tumors reported in this series only 2 patients were alive 3 years or more after operation, and 19 (91 per cent) were dead. It is a rather curious fact that out of 10 cases in this series containing cartilage all died but 1 and all cases containing papillary and squamous epithelial nests died.

The carcinomatous type of tumor is a malignant growth but of a lesser degree than the mixed type. Its evolution is slow and it remains limited for a considerable length of time. This is the kind which may be eradicated if treated early. Out of 39 cases of this variety in this series, which could be followed to death or shown to be alive 4 years or more after operation, 23 were dead and 16 were living. This gives a morbidity of 60 per cent. The prognosis is also better in the small tumors in which the cord and epididymis are uninvolved.

The prognosis in the abdominal type of tumor is especially bad, for the majority of patients do not present themselves for treatment until fairly late in the disease, owing to the fact that no symptoms may be noticeable until complications from pressure arise.

The dermoids are benign as a rule but this benignity has two reservations: (1) all such tumors are subject to malignant change and (2) it is impossible to draw a line between a relatively simple dermoid and a particularly complex mixed tumor.

TREATMENT

Simple castration has been the method of treating such cases for many years but it has been disappointing from the curative standpoint. This, of course, does not apply to the benign types some of which may be treated by simple removal of the growth and the preservation of the testicular tissue and the others by simple castration. Gross, in his statistics of 26 malignant tumors of the testicle, cites three cases of "cures,"—2 for 2 years and 1 for 14 years. Out of the 101 cases reported in this paper, 34 were of the so-called mixed type. Out of 25 of these cases which could be traced only 6 were found to be living and well, as follows:

6 months after operation	3
8 months after operation	1
7½ years after operation	1
9 years after operation	1

Only 2 cases are known to be alive 4 years after operation and only 1 of these has lived 9 years. None has reached the 10-year limit. Of the 19 patients who died, the following table shows the time after castration:

7 days to 2 months	2
2 months to 6 months	2
6 months to 1 year	6
1 year to 2 years	3
2 years to 3 years	3
3 years to 4 years	1
4 years or over	2

There were 62 cases of the carcinomatous type of tumor. Fifty-four of these cases were traced and 23 were found to be dead, following castration. The following table shows the time after castration:

7 days to 2 months	1
2 months to 6 months	6
6 months to 1 year	4
1 year to 2 years	4
2 years to 3 years	3
3 years to 4 years	3
4 years or over	2

The 31 living patients were as follows:

6 months to 1 year postoperative	3
1 year to 2 years postoperative	4
2 years to 3 years postoperative	4
3 years to 4 years postoperative	5
4 years postoperative	6
6 years postoperative	2

7 years postoperative 1
8 years postoperative 1
9 years postoperative 1
11 years postoperative 1
14 years postoperative 1
15 years postoperative 1

Hence it is seen that 15 patients are alive 4 years or more after operation, and 3 are alive 10 years after operation.

Since the advent of Coley's serum, it has been used following castration in a considerable number of cases. In 1915, Coley reported a series of 52 cases treated in this manner and contends that a better prognosis is offered by such treatment than by the radical operation. Of these 52 cases, only 2 showed involvement of the lumbar lymph nodes clinically at the time of operation. Of the remaining 50, 18 are dead, 14 have been lost from observation, and 18 are living. Of these 18 who are living, 9 have well marked metastases, and will, in all probability, die; 3 are alive over 4 years since castration; 3 are alive over 3 years; 1 over 2 years; and 2 over 1 year.

Excluding the 2 inoperable cases and the 14 which were not followed, the remaining 36 show a certain mortality of over 80 per cent while none of the remaining 20 per cent has lived long enough to be pronounced cured. In my series, only 6 patients were treated by this method. Of these, 4 (66 per cent) are dead and 2 (33 per cent) are still living, 7 and 9 years after operation. However, these 2 were both the so-called carcinomatous type of tumor and about 33 per cent of them are cured by simple castration alone.

In this series 11 patients received X-ray or radium treatments following castration. X rays alone were used in 7 cases, X-ray and radium in 3 cases, and radium alone in 1 case. The results in the 7 cases treated by X ray are given in the following table:

1 living and well 4 years after operation.
1 living and well 3 years after operation.
1 living and well [illegible] years after operation.
1 died 3 months after operation.
2 died 7 months after operation.

Cases treated by X-ray and radium:

1 living and well 1 year after operation.
1 died 3 months after operation.
1 died 7 months after operation.

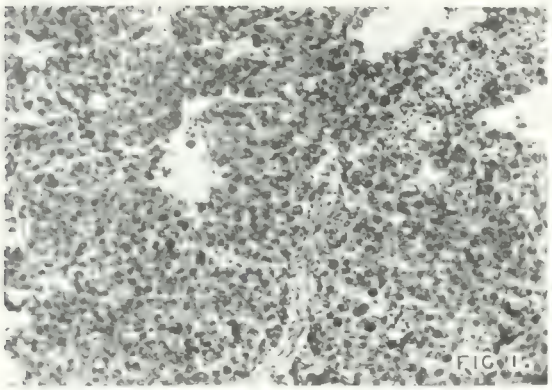
Cases treated by radium:

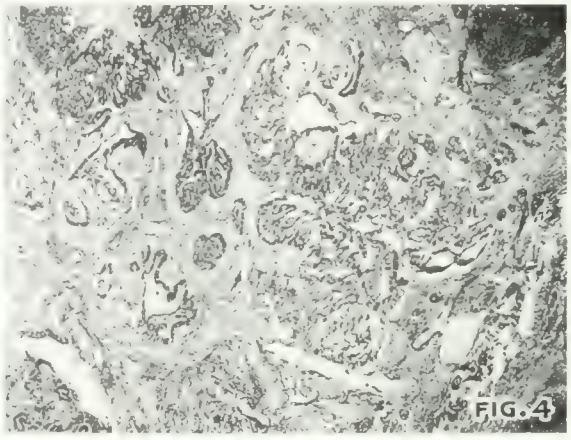
1 living and well 6 months after operation.

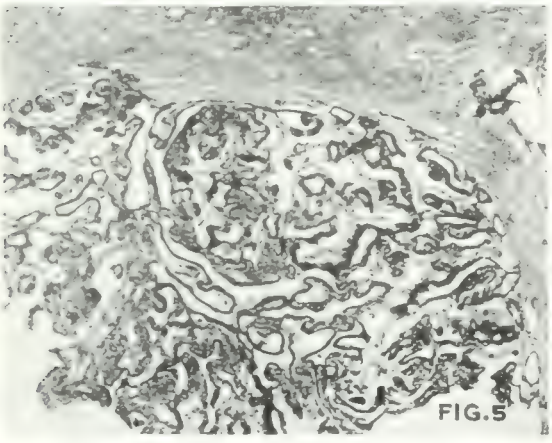
From these statistics it is seen that 5 out of 11 patients are dead and out of the 6 who are still alive only 1 patient is living over 4 years. Theoretically, the ideal treatment of malignant testicular tumors should consist in the ablation of the neoplastic organ, the lymphatics and all the nodes into which these lymphatics drain. Any given malignant tumor should be investigated as to its extension upward and in particular the state of the lumbo-aortic nodes. This is very difficult to determine. If a mass can be palpated deep in the abdomen below the umbilicus, the diagnosis is easy. But very frequently cases which are seen apparently early, and which show practically no involvement of the cord, except a slight thickening, are treated by castration and in a few months marked metastases in the lumbo-aortic nodes are seen. It is, therefore, fair to conclude that in every case of cancer of the testicle one should regard the lumbo-aortic nodes with suspicion. Complete castration should be followed by a systematic removal of the nodes draining this region.

The first operation of such character was performed by Roberts, of Philadelphia, in 1902. He operated upon a patient with recurrent malignancy of the testicle by a median abdominal incision and removed the lumbar nodes. The patient died of peritonitis 2 months later. The first successful operation of this kind was performed by Cuneo in 1906. He removed four enlarged lymph nodes, one of which showed malignant invasion, and the patient remained well and free from metastases for more than 3 years, at which time he disappeared from observation. Since that time numerous surgeons, especially in France, have adopted this operation.

Bland-Sutton says: "Tradition plays an unconscious part in the acts of the most unconventional surgeon. This is the only explanation I can offer concerning the universal practice among surgeons when performing the ancient operation of castration for malignancy of the testicle in allowing their efforts to be limited by the internal abdominal ring. It is undeniable that the modern method of extirpating the primary growth, the associated lymphatics and the







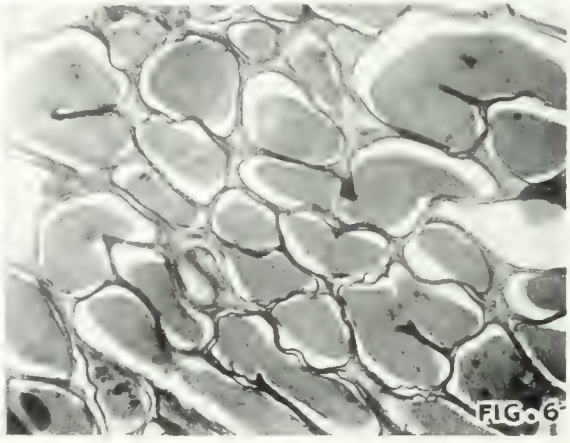


Fig. 1. Case 9. Typical large polyhedral shaped cells with deeply staining nuclei and pale cytoplasm, characteristic of the carcinomatous type tumor.

Fig. 2. Case 1. Cystic spaces and areas of cartilage in mixed type tumor.

Fig. 3. Case 12. Cystic spaces and nests of squamous epithelium containing pearl formations, found in mixed type tumor.

Fig. 4. Case 63. Peculiar gland-like structures.

Fig. 5. Case 65. Still another type of gland-like formation in mixed type tumor.

Fig. 6. Case 80. Low-power photomicrograph showing thyroid-like tissue. Other areas in same tumor also showed carcinomatous-like cells and still other areas showed gland-like structures.

lymph glands, in dealing with cancerous organs has greatly improved the remote results of operation designed for the relief of cancer. This is manifest in the case of the breasts, lips and labia."

Hinman has collected a total of 40 cases which were treated by the radical method. There was a combined surgical mortality in all cases of 11 per cent (3 deaths from pneumonia and 2 from peritonitis). Commenting on this mortality Beer says: "Even though at present the mortality of this operation is much higher than that of simple castration, experience has shown that such is the case with all new operations. The writer feels confident that during the next decade the mortality of this extensive operation will be markedly reduced."

Although sufficient time has not yet elapsed to enable us to estimate the ultimate results in all the cases treated by this method, Hinman found that 46 per cent were alive: one for 5 years, 1 for 4 years, 5 for almost 3 years, 2 for over 2 years, and 11 for 1 year or less. There is a probable cure in at least 1 cases which had lumbar nodes invaded with cancer at the time of the operation. Simple castration would not have cured any of these cases and their cure is directly attributable to the early and clean removal of the affected lymph node area.

Within the last 2 years Hinman has personally operated upon 6 cases of testicular tumor by the radical method without a single operative mortality. In 4 of these cases retroperitoneal lymph nodes containing metastatic tumor masses were removed. All 6 cases enjoy good health now 9 months, 7½ months, 4 months, 3 months, 2 months, and 3½ years, respectively, following operation. Naturally the ultimate result in these cases cannot be known for years. However, the finding of metastatic tumor tissue in the lymph nodes in 4 cases shows the futility of simple castration. A cure by the radical operation in any one of these 4 cases will have been due to the early and clean removal of the lymph draining area.

Technique of the operation. A simple castration is first performed through a high inguinal incision. The cord is dissected out as high up as possible and divided upon a clamp, preferably with a cautery. The clamp is left in place for traction on the spermatic vessels in the second part of the operation. At this stage the tumor is examined, and if found to be malignant on gross or microscopic examination, the second step of the operation is carried out. The incision is prolonged from the high inguinal incision made over the external ring to a point half an inch above the anterior superior spine. It then curves upward until it reaches the costal margin at the level of the tenth rib. The incision is carried through the muscle of the abdominal wall until the peritoneum is reached. The cord is traced until it passes through the internal abdominal ring and then with the sides of the incision strongly retracted, tension is applied to the cord in order to keep it recognizable. The peritoneum can then be stripped back by gauze dissection without carrying the cord with it. The cord is then traced well down into the true pelvis where it is divided between two ligatures.

The next procedure consists in the dissection of the fascia over a portion of the iliacus and psoas muscles, together with the spermatic vessels and lymphatics which it contains, and the removal of the nodes from off the inferior vena cava and aorta. Due to the fact that the spermatic vessels spread out above the point where the vas was ligated, it is necessary to make a wide dissection of the fascia on the outer side, and this should extend to the lateral border of the psoas muscle. On the inner side the line of division of the fascia should pass medially, crossing the common iliac at its bifurcation; here the ureter will be found and should be well exposed. The dissection is then carried upward along the inner side of the common iliac vessels to the aortic bifurcation. When the right testicle is the one involved the inner border is continued over the middle of the aorta; when the left testicle is the seat of the tumor the inner border is carried up along the right border of the aorta, where the inferior mesenteric artery must be carefully guarded. In either case the upper limit is the upper border of the renal veins. Everything between these boundaries must

be removed. The spermatic artery can be clamped as it emerges from the aorta and the vein as it enters the renal vein or inferior vena cava. After securing all bleeding points the peritoneum is allowed to fall back into place and the wound closed with drainage. This is best accomplished by a rubber tube put down to the aortic bifurcation and brought out as in kidney drainage. Hinman advises in those cases with apparent metastases the placing of a small rubber tube or catheter in the end of which is fastened a 50 milligram tube of radium alongside of the rubber drainage tube. In this way metastatic areas could be radiated from above downward by moving the catheter certain distances at intervals of one to two hours.

The radical operation should never be undertaken when abdominal metastases are recognizable clinically and should be used only in those cases in which the disease is apparently limited. Owing to the deep position of the nodes these cases cannot always be differentiated before operation, so that every case in which there is clinically no invasion is suitable for this operation. Before proceeding with the operation, the diagnosis should be confirmed by examination of the tumor following the first stage of the operation, castration. This would prevent further operation in cases of syphilitic testicles in which an incorrect diagnosis had been made. The non-operative treatment consists of Coley's serum, radium or X-ray treatments, and should be used in all cases which show abdominal metastases clinically.

SUMMARY

1. New-growth of the testicle occurs about once in 2000 male hospital admissions.

2. The disease is practically always unilateral—involving both sides only as a metastatic growth from the skin, seminal vesicles, etc.

3. Trauma as an etiological factor in these tumors evidently has some foundation.

4. Practically all cases occur between the ages of 18 and 50 years, the period of greatest sexual activity.

5. Both testicles are involved with about equal frequency.

6. Undescended testicles within the canal are more apt to become malignant than normally placed organs. Undescended testicles within the abdomen are relatively immune to malignant changes.

7. The average mortality of these tumors taken from the literature is about 80 per cent, based on a 4 year postoperative period.

8. In this series the mortality was found to be about 70 per cent.

9. The so-called mixed type of tumor gives a much higher mortality than the carcinomatous type. In this series it was 90 per cent in the former type and 60 per cent in the latter.

10. Tumors containing cartilage and squamous epithelium seem to have a decidedly unfavorable prognosis.

11. The prognosis in abdominal tumors is also very bad—only 6 per cent of a large series being alive and well 2 years after operation.

12. The radical operation should be performed in all cases in which the disease is apparently limited, i.e., in cases showing no abdominal metastases clinically.

13. The ordinary castration operation, even when supplemented by Coley's serum, X-rays or radium, does not yield satisfactory results.

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OVARIAN TRANSPLANTATION

I. Brief Abstract of Articles Published in 1917 to 1921 Inclusive. II. Abstracts Arranged by Subjects. III. Author's [illegible] IV. [illegible]

By Frank H. Martin, M.D., F.A.C.S., Chicago

I. Brief Abstract of Articles Published in 1917 to 1921 Inclusive

In a paper on the transplantation and retention of ovarian tissue after hysterectomy, Graves (52) has come to the conclusion that the retention of ovaries after hysterectomy insures only a slight improvement in the menopause symptoms over ablation, and this slight advantage, if it exists at all, does not compensate for the dangers of adhesions with cyst formation, malignant degeneration, and physiological disturbances which the conservation of the ovaries entails. Transplantation made within the leaves of the broad ligament in the paracervical cellular tissue proved unsatisfactory in the first case because the transplanted tissue became cystic and painful.

Transplantations made in the abdominal rectus muscle are of doubtful value, according to results tabulated by the author, more trouble being reported by the patients than in cases of total ablation. Making allowances for limited observations and variations in patients' reports, "the conclusion is inevitable that when the uterus has been extirpated, transplanted ovarian tissue probably *has no marked influence one way or the other* on the surgical menopause symptoms." Tuffier is of the same opinion. Chalfant also reaches similar conclusions, except that in some 17 cases recorded he did find an improvement over 40 total ablation cases. The experience of the author, of Tuffier, and of Chalfant supports the theory that "so-called ablation symptoms are due to a breaking of the utero-ovarian harmony, and that if the uterus is removed the retention of ovarian tissue *in situ* or by transplantation is of little physiological value."

If the *uterus is not removed*, the utero-ovarian harmony may be retained for a time at least by transplanted ovarian tissue, so that menstruation may continue and ablation symptoms be prevented. However, the author questions the advisability of leaving the uterus by itself in the pelvis, with the ovaries transplanted to some distant part. His experience leads definitely to the conclusion that when both ovaries are removed, the uterus also should be extirpated, for an isolated uterus almost invariably causes trouble and frequently requires removal. Implantation of the ovaries "does not in any way obviate this difficulty."

It is possible to restore utero-ovarian harmony by heteroplastic transplantation in castrated women in whom the uterus has been left *in situ*, so that menstruation is resumed and ablation symptoms made to disappear. Such operations are not universally successful, as heteroplastic grafts do not always take into account the physiological antagonism of blood and tissue that exists between different individuals. Where castration with extirpation of the uterus is followed by historic menopause symptoms of the severest type, heterotransplantation may be useful in some instances.

After having tried the various sites for ovarian transplantation, Mauclaire (94) has come to the conclusion that the best results follow the intra-epiploic graft which is most rapidly vascularized. In a series of ten intra-epiploic autografts, eight cases were followed and menstruation had occurred in all. Out of five cases of intra-epiploic homografts, two had been followed and the results seemed permanent. The question of inheritance in the case of the homograft is still an open one, as is also the question as to whether blood from the donor should be injected into the recipient as a preliminary to the operation. The success of the intra-epiploic heterograft is yet to be tested.

[illegible]

[illegible] reports a case in which a human ovary was grafted to either side of the broad ligament in a patient who had had no ovaries. A year later the vagina, which had been very narrow, had grown somewhat. In 3 years, both uterus and vagina had increased considerably in size, so that cohabitation could occur without pain. At intervals of from 7 to 8 weeks the breasts swelled, and a bloodless excretion emanated from the vagina. Conditions remained unchanged up to the time of writing, 5 years after operation.

There are, according to Unterberger (142), only two indications for transplantation of the ovary: bilateral benign ovarian tumors, in cases where resection is not practicable; severe chronic affections of the adnexa especially pyosalpingitis with adhesions about the ovaries) which resist conservative treatment.

Both ovaries, affected with benign tumor, were removed by the writer from a young patient. Under microscopic examination, some normal tissue was discovered. Disks of this tissue were implanted in abdominal walls between the rectus muscle and the sheath. After a 3 months' menopause, menstruation occurred with comparative regularity. It was preceded each time by a slight swelling of the transplanted elements.

The writer has employed the same method in severe cases of inflammation of the adnexa and in cases of pyosalpingitis in which continued conservative treatment had been of little avail. Although conservative treatment is generally favored in pyosalpingitis, operation is frequently necessary. The results were in no case very favorable. When the diseased adnexa were removed on both sides, abrupt cessation of menstruation occurred. The patients were usually young. When an adhering ovary was preserved *in situ*, new adhesions appeared between the ovary and its surroundings. In these cases the writer took portions of the sterile ovary and transplanted them to the abdominal walls. This simplified the healing of the wound in the abdominal cavity and preserved menstruation without giving rise to new adhesions.

This operation was performed on nineteen women. Only those cases were considered in which it was possible to remove completely all ovarian tissue from the abdomen. Menstruation appeared from 2 to 7 months after the operation, the period coinciding in each case with the interval required for the healing of the transplanted tissue. In a woman in the forties, however, the return of menstruation was rapidly followed by complete menopause. In the younger women, menstruation could usually be prolonged for 5 years. It was found that the climacteric appears earlier in these cases than in the normal, but that the menopause occurs more normally than in cases of operative castration.

Homoplastic transplantation has been less successful in therapeutic cases than in experimental investigations, possibly owing to the fact that in the case of animals, normal ovaries are employed, while with human beings a pathological organ is always involved. We have not yet determined, moreover, to what extent the diseased condition is influenced by the internal secretions of other glands. The conditions for transplantation offer still more contrast in cases where the ovaries have been removed for a considerable length of time. In the latter case, homoplastic transplantations are worthless.

In a more extensive contribution to the subject, Unterberger (143) draws the following conclusions:

A. *Autoplastic operations* (transplantation of the patient's own ovaries).

(1) The ovaries can be very reliably grafted by autoplastic procedures in the human female; (2) fragmentary transplantation furnishes better results than transplantation of the whole ovary; (3) as the site of transplantation, in laparotomy cases, the anterior abdominal wall, between the rectus and the anterior sheath of the rectus, is recommended; (4) even up to the end of 5 years after autoplastic transplantation, regular menstrual periods are observed; (5) autoplastic grafting is indicated: (a) in the presence of benign bilateral ovarian tumors; (b) in grave bilateral disease or suppuration of the adnexa.

B. *Homoplastic operations* (transplantation of ovaries from other women).

(1) The results are very unreliable; (2) in women who have been castrated a long time ago, or who have arrived at the menopause, ovarian transplantations are always unsuccessful; (3) homoplastic operations are indicated only in the presence of atrophy or infantilism of the genitals, with preservation of the ovaries of the recipient.

C. *Heteroplastic operations* (transplantation of non-human ovaries).

(1) The ovaries of certain species of macacus apes enter into consideration; (2) the indication for the performance of the grafting is the same as in homoplastic transplantation.

In Cramer's (34) experience extraperitoneal transplantation has proved more successful than intraperitoneal, especially when the graft is placed in the cavity of Retzius or within the rectus muscle. In some instances, thin disks taken from the ovarian surface after removal of the stroma were sutured to the muscle. The results were most satisfactory when a large amount of corpus luteum was included. Ninety-five autoplastic operations were divided into the following groups: (1) reimplantation of one ovary, with preservation of the other *in situ* (32 cases); (2) reimplantation following removal of both ovaries, with preservation of the uterus (26 cases); among nineteen cases examined menstruation was preserved in eighteen; (3) reimplantation with removal of the uterus and both adnexa (37 cases). Menopause symptoms were absent in thirty of the latter group. In seven homoplastic cases, menses were re-established in three cases, severe menopausal symptoms disappeared in two cases, while in two cases of castration results were negative in consequence of anaphylaxis.

De Rouville and Cohen (121) have reported two cases which seem to prove quite definitely that the re-establishment of menstruation after autotransplantation is dependent upon the grafted ovary and not upon ovarian fragments left behind at the time of the oophorectomy. In the first case, a woman 23 years of age, in which the patient's own ovaries were transplanted under the lips of the laparotomy incision, the patient suffered from menorrhagia, metrorrhagia, and swelling and tenderness of the grafts at periodic intervals 18 months after the operation. Menstruation and all untoward symptoms ceased following removal of the grafts. Microscopic examination demonstrated not only the persistent vitality of the grafts, but certain incipient degenerative changes in the corpora lutea which probably accounted for the disturbed endocrine balance.

In the second case, both ovaries were removed from a woman 32 years of age and a portion of the right ovary grafted in the subcutaneous tissues of the right side. Menstruation was re-established 3 months after the operation and remained regular for 6 months, at which time severe pain in the left iliac fossa called for a second operation. A subtotal hysterectomy was performed, and the uterus was found to be undergoing sclerotic changes which probably coincided with the disappearance of the trophic function of the grafted ovary.

As a result of careful microscopical studies of ovarian transplantation in guinea pigs, Athias (10) has found that in the graft sections the epithelial layer usually shows invaginations, that the epithelial cells increase in size and take on a globular form with nuclei containing mitotic and karyokinetic figures 5 to 8 days after operation, and that among these epithelial cells are certain elements which in form, size, and structure closely resemble oocytes. The author has not yet traced a complete cycle of nuclear transformation, but he feels justified in concluding that in ovarian transplantation, an ovular neoformation can be produced at the cost of invagination of the superficial epithelium.

By careful study of sections of transplanted ovaries, Long and Evans (75) have demonstrated that the grafts contain healthy and atretic follicles, corpora lutea of several ages, and interstitial tissue. While there was no actual evidence of true ovulation, there was, nevertheless, an apparent rhythmic production of corpora lutea from unbroken follicles, as is known to occur rarely in normal animals. In another series of experiments by the authors (76) the transplantation of adult ovaries into young animals resulted in a sudden maturity of the gland.

Bell (17) has recently recorded his experience in a series of ninety-eight cases of ovarian transplantation as follows:

1. Total number of cases recorded, 98. Indication for operation

A. Salpingo-oophoritis

Primary lesion	81
Associated appendicitis	4
With fibromyomata uteri	5

B. Innocent neoplasms, bilateral or of [illegible] ovary	1
C. Ovarian pain with functionless uterus.	1
Total number of cases excluded, 31.	
A. Operations within 6 months	10
b. [illegible] operation	1
C. Failure to obtain after-histories	20
Total number of cases analyzed, 67	
A. Number of cases in which menstruation was possible	57
a. Number of cases in which menstruation occurred	38
b. Number of cases which did not menstruate and in which there was no menopausal symptom	9
c. Number of cases which did not menstruate and in which there were menopausal symptoms	10
B. Number of cases in which subsequent menstruation was possible owing to supravaginal or complete hysterectomy having been performed	10
a. Number of cases in which menopausal symptoms did not occur	7
b. Number of cases in which menopausal symptoms occurred	3
C. a. Number of cases in which functional results were obtained	54
b. Number of cases in which there was failure to obtain functional results	13

The author notes that in two cases there was painful swelling of the graft associated with rather profuse menstruation; in another case a small graafian follicle retention-cyst caused continuous uterine hæmorrhage: the cyst was excised from the rectus muscle under local anæsthesia. In the cases in which menstruation returned, menopausal phenomena persisted until the secretion from the implanted ovarian tissue was available. In only a few cases did menstruation become regular. The chief indication for the procedure, according to the author, is a serious pelvic infection, particularly that due to the gonococcus, which has rendered further conception impossible. The operation is contraindicated in women over 42, in women sexually inactive, and in all cases in which conservation is possible. The important points in Bell's technique are as follows:

1 All grafts in the human subject must be autoplastic. 2 After the ovaries have been removed the ovarian tissue from which the graft is cut should be dropped to the bottom of the pouch of Douglas, where it will be kept warm and moist until the end of the operation when it is required for grafting. 3 When possible, healthy ovarian tissue, which may include all the elements of the organ, should be used. This should be criss-crossed with a sharp knife into adherent fragments, after the dense tunica albuginea has been removed in order to favor rapid vascularization of the grafted tissue. 4 The graft, provided there is no suppurative infection of the ovary, may be placed in the rectus muscle before the laparotomy wound is closed. I have also implanted the graft in the uterus or what was left of the organ. It is most important that the graft should be placed in a vascular site, yet it should not be surrounded with blood. Too much care cannot be taken in placing the graft among the muscle fibers; 5 If the ovaries are badly infected and more or less completely converted into the walls of abscess cavities, whatever tissue can be removed should be implanted in the internal oblique muscles alongside the drainage tube, which in such circumstances is passed through a stab wound well away from the central incision into the pelvis. I have, however, never seen an infected graft slough; moreover, in several such cases, menstruation has subsequently occurred.

The author concludes with emphasis on the fact that "this procedure should be looked upon as a measure of necessity, which can never be weighed in the balance against the preservation of the natural connections of the normal ovary."

As the result of a series of experimental studies following oophorectomy, Bailey (11) has come to the conclusion that a very definite interrelation exists between the uterus and the ovaries. Metabolism investigations showed a reduction both of the oxygen consumed and of the carbon dioxide eliminated after removal of the ovaries, the greatest reduction occurring 2 to 3 months after operation when atrophic changes have probably taken place in the uterus. Previous experiments by Marshall and Jolly and others have clearly demonstrated that oophorectomy is followed by fibrosis and atrophy of the uterus. Hence, it is clear that the uterus depends upon some trophic influence from the ovary for its maintenance. The influence of the uterus upon the ovaries is not so clear. The author found that experimental hysterectomy in young animals was followed by normal ovarian development, while in adult animals no change in the ovaries could be demonstrated until after a 3 or 4 month period. Clinical experience has shown that the menopause occurs after hysterectomy even though the ovaries remain. The author

is, therefore, of the opinion that "transplantation of the ovary is of no value in relieving menopausal symptoms, unless the uterus or part of it remains."

Two hundred and thirty ovarian graft operations have been performed by Tuffier (139) during the past 14½ years. The object of this procedure was:

1. To conserve or re-establish the physiological state and menstruation after removal of the ovaries and the tubes when the uterus has been preserved.

2. To try to ameliorate the symptoms due to complications following the removal of the uterus and of the ovaries.

Sixty of the transplantations were performed after total or supravaginal hysterectomy, 156 after oophorectomy with total conservation of the uterus, and four after oophorectomy and subtotal hysterectomy. Four patients of the 230, or 1.8 per cent, died from abdominal infection due to the original disease.

The seat of the autograft or homograft was subcutaneous cellular tissue (71 cases), subperitoneal cellular tissue (54 cases), and in some cases, the posterior of the mammary gland (3 cases), the site not being stated in the remainder.

The true graft (homograft) is the grafting of the ovary of one woman into another woman (20 cases). Transposition (autotransplantation) is the removal of the ovary from the abdomen and its transposition in subcutaneous or subperitoneal cellular tissue (203 cases). In six cases, both homografts and autografts were used.

A homograft never resulted in the physiological re-establishment of menstruation. Menopausal disturbances following hysterectomy and castration were never suppressed by immediate or late homografts, although the symptoms were slightly ameliorated in some cases.

The condition of the ovary used in the autograft cases was normal or sclerotic, often microcystic, situated in contact with an infected region, but itself free from the infection. The conditions necessitating castration in the cases on which this paper was based were salpingitis (141 cases), fibroma (35 cases), extra-uterine pregnancy [illegible] cysts [illegible] cases), and grave disturbances of the menopause [illegible]

The nature and the duration of the conditions for which the ovaries were removed seem to have little influence on the therapeutic result. On the other hand, the age of the patient is important, favorable results seldom occurring after the age of [illegible] Generally, the graft did not give rise to pain or other symptoms during the first 4 or 5 months, although slight congestive phenomena may occur at the site of the graft. In five cases these congestive phenomena were repeated and menstruation did not follow. During this period, the patient presented all the usual signs of castration. From the fifth to the seventh month, if the graft is efficacious, it increases in size periodically and becomes congested for perhaps a week prior to menstruation. The return of menstruation can be obtained only in the cases where the uterus or two-thirds of it is preserved. Extirpation of the fundus does not necessarily prevent the return of menstruation. This function returns in 5 to 7 months after the graft, rarely [illegible] months.

During the entire period of the operation and the re-establishment of menstruation, the patient shows all the signs of the menopause. All these disappear after the first start of the flow of blood. This menstruation is not regular as to quantity, duration, or periodicity. The site of transplant does not seem to influence the result. The transposed ovaries have a new vascularization, but undergo degenerative changes more rapidly than ovaries in their normal position.

Of seventy-three cases in which the ovary was transplanted with preservation of the uterus and in which from [illegible] months to [illegible] years have followed the operation, menstruation has been regular in fifty-six (76.71 per cent). The youngest patient was 18 and the oldest 41 years of age. The ages of the other patients ranged from [illegible] to [illegible] years. Menstruation usually returns 5 to 7 months after the transplantation; if it appears earlier, it is due, Tuffier believes, to a section of ovary left at operation.

The accompanying table gives the [illegible]

					Disappearance after start	Mode of graft
						Auto
		Salpingitis	?	7 months		Auto
					17 months	Auto
					2 months	Auto
		Salpingitis		?		
					6 months	Auto
					4 months	
						Auto
	25	Salpingitis		8 months	2 years,	
	17			Reviewed after 1 year	1 year	Auto
21			1 month	Reviewed after 3 years, 3 months	3 years, 4 months	Auto
			2 years	Reviewed after 2 years, 6 months		Auto
	27	Salpingitis		Reviewed after 17 months	19 months	Auto and homograft

strual record of thirteen cases out of the 230 on which the paper is based.

Following a visit to Tuffier's clinic, G. R. White (147) with Charles Usher had the opportunity of operating on fifty-five cases which are the basis of a recent report.

The general technique of the operation used by them is to remove the ovaries and tubes, leaving the uterus. The parts not desirable for the graft are trimmed away, the ovaries opened and inserted one on each side between the rectus muscle and the peritoneum well out toward the lateral edge of the muscle. No suture is required and the abdominal wound may be closed in the usual way. Drainage of the peritoneal cavity may or may not be employed and sepsis, if not excessive, does not interfere with the grafts.

The indications for the operation vary. If the case is one in which the pathological condition can be corrected or removed, a conservative operation should be performed. and the ovarian graft has no substitute. In cases where pregnancy is impossible and the ovaries, if left behind, would be a menace to the health of the patient, Tuffier's graft offers a method whereby the advantages of a radical operation may be obtained and at the same time the menstrual function preserved.

Three of the author's cases were for nervous conditions associated with menstruation. One, a case of true epilepsy with severe attacks at the menstrual period, was improved by the operation. A case of hystero-epilepsy with normal genitalia was not improved. The third case was that of infantile uterus with dysmenorrhœa and hystero-epilepsy. There was no hysterical attack at the time of writing, which was one year after the operation. Twenty of the fifty-five cases have been followed to date. In all but one case menstruation was re-established, beginning in from one to 6 months after the operation. In two cases menstruation ceased and the menopause came on within a year. In the majority of cases, menstruation became regular and ceased between the second and third year. In two cases it ceased after 5 years, and in one case, 6 years intervening since the operation, it still continues. About half of the patients complain of excessive menstruation the first few months after re-establishment of the function. When menstruation ceased, nearly all patients had flushes and the usual symptoms of the menopause, but in no case were they excessive. There has been no case of marked obesity; nearly all speak of greatly improved health.

The author summarized the results by stating that Tuffier's graft re-establishes menstruation after oophorectomy in practically every case. Menopause comes on gradually and is similar in all essentials to the normal menopause. This operation "saves the patient from much physical and psychic discomfort."

II. Summary of Abstracts Arranged by Subjects

1. Indications for Transplantation

The chief indications for ovarian transplantation are: Bilateral benign ovarian tumors in cases in which resection is not practicable, and severe chronic affections of the adnexa which resist conservative treatment (Unterberger).

The chief indication for transplantation is a serious pelvic infection, particularly that due to the gonococcus. In 98 cases only five grafts were made in the absence of pelvic infection. The operation is contra-indicated in women over 42, in women sexually inactive, and in all cases in which conservation is possible. It "should be looked upon as a measure of necessity, which can never be weighed in the balance against the preservation of the natural connections of the normal ovary" (Bell).

The object of transplantation in 230 grafts performed by Tuffier was: (1) to conserve or re-establish the physiological state and menstruation after removal of the ovaries and the tubes when the uterus has been preserved; (2) to try to ameliorate the symptoms due to complications following the removal of the uterus and of the ovaries. Sixty of the transplantations were performed after total or supravaginal hysterectomy, 156 after oophorectomy with total conservation of the uterus, and four after oophorectomy and subtotal hysterectomy. Four patients of the 230, or 1.8 per cent, died from abdominal infection due to the original disease (Tuffier).

Out of fifty-five grafts, three were performed for nervous conditions associated with menstruation (White).

2. Influence of Oophorectomy upon the Uterus

A very definite interrelation exists between the uterus and the ovaries. Metabolic studies showed a reduction both of the oxygen consumed and of the carbon dioxide eliminated after removal of the ovaries, the greatest reduction occurring 2 to 3 months after operation when atrophic changes have probably taken place in the uterus. The uterus [illegible] trophic influence from the ovary for its maintenance (Bailey).

3. Transplantation with Uterus [illegible]

If the uterus is not removed, ovarian transplantation may retain the utero-ovarian harmony for a time, but Graves has come to the conclusion that the uterus should be extirpated when both ovaries have been removed as [illegible] uterus is likely to cause trouble which implantation of the ovaries cannot obviate.

The climacteric appears earlier than normal in cases in which the ovaries have been transplanted, but the menopause occurs more normally than in cases of operative castration (Unterberger).

4. Transplantation after Hysterectomy

The experiences of Graves, Tuffier, and Chalfant indicate that the retention of ovarian tissue *in situ* or by transplantation after removal of the uterus is of little physiological value (Graves).

"Transplantation of the ovary is of no value in relieving menopausal symptoms, unless the uterus or part of it remain" (Bailey).

The return of menstruation can be obtained only in the cases where the uterus or two-thirds of it is preserved (Tuffier).

5. Sites for Transplantation

Mauclaire has come to the conclusion that the best results follow the intra-epiploic graft, which is easily vascularized.

Thin disks of ovarian tissue may be implanted in the abdominal wall between the rectus muscle and its sheath (successful case reported by Unterberger).

Successful case of homograft on either side of the broad ligament has been reported by Schickele.

As the site of transplantation, in laparotomy cases, the anterior abdominal wall, between the rectus and the anterior sheath of the rectus, is recommended (Unterberger).

Extraperitoneal transplantation is more successful than intraperitoneal, especially if the graft is placed in the cavity of Retzius or

within the rectus muscle. Thin disks were sutured to muscle (Cramer).

The seat of the autograft or homograft was subcutaneous cellular tissue (71 cases), subperitoneal cellular tissue (54 cases), and in some cases, the posterior of the mammary gland (3 cases), the site not being stated in the remainder (Tuffier).

The site of the transplant does not seem to influence the result (Tuffier).

The ovaries should be opened and inserted one on each side between the rectus muscle and the peritoneum well out toward the lateral edge of the muscle (White).

Bell states that—

"a. All grafts in the human subject must be autoplastic.

"b. After the ovaries have been removed the ovarian tissue from which the graft is cut should be dropped to the bottom of the pouch of Douglas, where it will be kept warm and moist until the end of the operation when it is required for grafting.

"c. When possible, healthy ovarian tissue, which may include all the elements of the organ, should be used. This should be criss-crossed with a sharp knife into adherent fragments, after the dense tunica albuginea has been removed in order to favor rapid vascularization of the grafted tissue.

"d. The graft, provided there is no suppurative infection of the ovary, may be placed in the rectus muscle before the laparotomy wound is closed. I have also implanted the graft in the uterus or what was left of the organ. It is most important that the graft should be placed in a vascular site, yet it should not be surrounded with blood. Too much care cannot be taken in placing the graft among the muscle fibers.

"e. If the ovaries are badly infected and more or less completely converted into the walls of abscess cavities, whatever tissue can be removed should be implanted in the internal oblique muscles alongside the drainage tube, which in such circumstances is passed through a stab wound well away from the central incision into the pelvis. I have, however, never seen an infected graft slough; moreover, in several such cases, menstruation has subsequently occurred."

6. AUTOPLASTIC TRANSPLANTATION

Out of ten intra-epiploic autografts, eight cases were followed and menstruation had occurred in all (Mauclaire).

Unterberger reports successful results in nineteen cases, menstruation appearing from 2 to 7 months after the operation and being prolonged for 5 years in the younger women. The following conclusions are reached by Unterberger:

"a. The ovaries can be very reliably grafted by autoplastic procedures, in the human female.

"b. Fragmentary transplantation furnishes better results than transplantation of the whole ovary.

"c. As the site of transplantation, in laparotomy cases, the anterior abdominal wall, between the rectus and the anterior sheath of the rectus, is recommended.

"d. Even up to the end of 5 years after autoplastic transplantation, regular menstrual periods are observed.

"e. Autoplastic grafting is indicated: (a) in the presence of benign bilateral ovarian tumors; (b) in grave bilateral disease or suppuration of the adnexa."

Cramer reports ninety-five autoplastic operations as follows: (1) reimplantation of one ovary, with preservation of the other *in situ* (32 cases); (2) reimplantation following removal of both ovaries, with preservation of the uterus (26 cases); among nineteen cases examined, menstruation was preserved in eighteen; (3) reimplantation with removal of the uterus and both adnexa (37 cases). Menopause symptoms were absent in thirty of the latter group.

"All grafts in the human subject must be autoplastic" (Bell).

Out of 57 cases of autografts in which menstruation was possible, it was re-established in 38; of the remaining 19 cases, menopausal symptoms occurred in 10. Of 10 cases in which hysterectomy precluded the re-establishment of menses, menopausal symptoms occurred in 3. In the cases in which menstruation returned, menopausal phenomena persisted until the secretion from the implanted ovarian tissue was available. In only a few cases did menstruation become regular (Bell).

7. HOMOPLASTIC TRANSPLANTATION

The question of inheritance in the case of the homograft is still open, as is also the question as to whether it is advisable that blood from the donor should be injected into the recipient as a preliminary to the operation (Mauclaire).

Out of five cases of intra-epiploic homografts, two had been followed and the results seemed permanent (Mauclaire).

Schickele reports successful results in a case in which a human ovary was grafted to either side of the broad ligament.

"a. The results are very unreliable.

"b. In women who have been castrated a long time ago, or who have arrived at the menopause, ovarian transplantations are always unsuccessful.

"c. Homoplastic operations are indicated only in the presence of atrophy or infantilism of the genitals, with preservation of the ovaries of the recipient" (Unterberger).

In seven homoplastic cases, menses were re-established in three cases, severe menopausal symptoms disappeared in two cases, while in two cases of castration results were negative because of anaphylaxis (Cramer).

Homograft alone was performed by Tuffier in 20 cases. In 6 cases, homografts and autografts were combined (Tuffier).

A homograft never resulted in the physiological re-establishment of menstruation. Menopausal disturbances following hysterectomy and castration were never suppressed by immediate or late homografts, although the symptoms were slightly ameliorated in some cases (Tuffier).

8. HETEROPLASTIC TRANSPLANTATION

The utero-ovarian harmony may be restored by heteroplastic transplantation, but this operation has not been universally successful, as heteroplastic grafts do not always take into account the physiological antagonism of blood and tissue that exists between different individuals and different species (Graves).

The success of the intra-epiploic heterograft is yet to be tested (Mauclaire).

"a. The ovaries of certain species of macacus apes enter into consideration.

"b. The indication for the performance of the grafting is the same as in homoplastic transplantation" (Unterberger).

9. RESULTS FOLLOWING AUTOGRAFTS AND HOMOGRAFTS

Of 73 cases in which the ovary was transplanted with preservation of the uterus and in which from 4 months to 12 years have followed the operation, menstruation has been regular in [illegible] per cent). The youngest patient was 15 and the oldest 42 years of age. The ages of the other patients ranged from 18 to 40 years. Menstruation usually returns 5 to 7 months after the transplantation; if it appears earlier it is due to a section of ovary left at operation (Tuffier).

Twenty out of 55 cases operated upon by White have been followed to date. In all but one case menstruation was re-established, beginning in from 1 to 6 months after the operation. In two cases menstruation ceased and the menopause came on within a year. In the majority of cases, menstruation became regular and ceased between the second and third year. In two cases it ceased after 5 years, and in one case, 6 years intervening since the operation, it still continues. About half of the patients complain of excessive menstruation the first few months after re-establishment of the function. When menstruation ceased, nearly all patients had flushes and the usual symptoms of the menopause, but in no case were they excessive. There has been no case of marked obesity and nearly all speak of greatly improved health (White).

10. MICROSCOPICAL CHANGES IN OVARIAN GRAFTS

After finding invaginations of the epithelial layer and cells closely resembling oocytes, Athias has concluded that in ovarian transplantation an ovular neoformation can be produced at the cost of invagination of the superficial epithelium.

Long and Evans found no actual evidence of a true ovulation, but there was an apparent rhythmic production of corpora lutea from unbroken follicles, as corpora lutea of several ages were demonstrated in sections.

III. Author's Conclusions

This surgical subject, the scientific aspect of which is intertwined with so much that appeals to the more human imagination, is one, judging from the literature and the lack of interest manifested in it by serious minded surgeons, whose lack of progress is not overstimulating to a disinterested observer.

My first report was made in 1903; my second report in 1908; my third in 1911; my fourth in 1915; my fifth in 1917. As in this, my sixth report, I have attempted each time to bring the literature up to date, and to furnish a complete bibliography.

I can summarize my impression of the whole subject by saying that as more evidence is accumulated from the literature, the claims of the earlier enthusiasts seem to become less and less substantial.

The one most hopeful feature that I am able to glean from the mass of more or less loosely recorded evidence is that the clinical records dealing with transplantation in the human show that while autotransplants give some evidence of success, homotransplants and heterotransplants give practically none at all. On the other hand, definite evidence of success is recorded as the result of carefully conducted experiments on animals in which matters of selection of appropriate material and proper technique are more controllable than in dealing with the human. May we hope that this fact and a more careful study of the subject from a scientific and experimental standpoint will reverse the unsatisfactory showing?

In the meantime, in the light of previous publications, the opinions expressed in the writings on this subject in 1918, 1919, 1920, and 1921, may be summarized as follows:

1. Clinically, there is very little to encourage one to believe that transplantation of ovaries as practiced up to the present time has more than speculative value as a surgical procedure.

2. There is some evidence that autotransplants are of some value in deferring the symptoms of the menopause and delaying the cessation of menstruation. It is difficult, however, not to attribute some of this evidence to suggestive therapeutics or to unattached ovarian tissue left *in situ*.

3. There is practically no convincing evidence that homotransplants have been successful in the human female.

4. There is no evidence that heterotransplants have been successful where the human female has been the recipient.

5. There is some encouraging evidence recorded in experimental animal surgery that not only autotransplants, but homotransplants and even heterotransplants have been successful and the sexual function of the castrated animal maintained.

6. The technique followed by the various operators on human females, in too many instances, seems unsurgical and too often is incompletely and loosely recorded, leaving the impression that the conclusions derived from such work must be unreliable.

7. There is, however, encouraging evidence in all of this endeavor to lead one to hope that the subject will be pursued experimentally, especially for the purpose of devising a rational and simple technique, based on the work of the serologists, the endocrinologists, the hæmotologists, and the practical clinical surgeons.

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TRIPARTITE CLEFT PALATE AND DOUBLE HARELIP IN "IDENTICAL" TWINS[1]

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[illegible]

IN the literature of cleft palate and harelip and by personal communication, I have been unable to discover a case where "identical" twins were both afflicted with congenital tripartite cleft palate accompanied by double harelip. Truman W. Brophy (1) reported six cases of twins in which one of the twins had a cleft palate. William L. Shearer (2) reported three cases of cleft palate twins. One of these was of "identical" twins, in which both children were afflicted with clefts involving both the hard and soft palate; both were girls; one had a harelip on the right side, and the other a harelip on the left side. In another case one child was normal and the other had a single cleft palate. His third case was that of a boy and girl, one of whom had a cleft of the soft palate; the other a cleft of the hard palate and a single harelip. M. N. Federspiel (3) has never had a case of twins with this deformity, but he reported an interesting case in which a family of four children were afflicted. The first had a single harelip; the second had a cleft of the lip and alveolar process; the third, who died shortly after birth, a double cleft of the lip and alveolar process; and the fourth a single cleft palate and harelip. Robert H. Ivy (4) reported that in his practice he had never met with a case of tripartite cleft palate in twins. Thomas L. Gilmer (5) stated that in 40 years of active work in oral surgery he had never met with a case of twins with this deformity. Gordon B. New (6), of the Mayo Clinic, stated that he had never encountered this condition. Vilray P. Blair (7), of St. Louis, has never had, in his practice, twins with harelip and cleft palate, but said that he had received a photograph of stillborn twins with both harelip and cleft palate, from Dr. Frederick Koontz, of Louisville, Kentucky, and that Dr. Samuel Mixter, of Boston, had described to him a case of twins each of whom had harelip. The complete absence of cases of tripartite cleft palate and double harelip in "identical" twins in the literature would seem to justify the following case report and a detailed study of this unusual deformity.

Mrs. T., age 26, married 9 years, occupation housewife, nationality Dutch and American, five pregnancies as follows: first, March 31, 1914, child full term, lived 17 days, normal; second, March 29, 1915, child full term, living and well, normal; third, April 1, 1918, child full term, living and well, normal; fourth, August 13, 1919, child full term, living and well, normal; fifth, December 24, 1921, twins full term, living and well, both males, with congenital cleft palate (tripartite type), double harelip.

Patient's father is living and well, age 54, normal; mother is living and well, age 49, normal; brothers, four, are living and well, and all are normal; one sister, living and well, and normal. She has no aunts, uncles, cousins, or grandparents with cleft palate or harelip.

The husband's father died when 54, of influenza, otherwise normal. The mother is living and well, age 52 and normal. He has two brothers, living and well, and one who died from scarlet fever. All were normal. He has one sister, dead, and four living and well, and normal. One brother has two normal children. One brother has three normal children. One sister has four normal children. Two sisters are not married. Husband had one sister, whose husband is normal and whose family history is absolutely negative, gave birth to a child with cleft palate and harelip, which lived 2 months and died. She later gave birth to a normal child.

Patient's past history is negative, and examination of all systems was negative. She is a robust young woman, rather stout, who looks her age. Laboratory report shows a negative Wassermann, and there is no history of uterine disease.

On December 23, 1921, while working about the house, the patient noticed labor pains, but decided to wait until morning before entering the hospital. Her pains increased in severity during the night, and at 2 a.m. the bag of waters ruptured. At 9:00 a.m. she entered the University Hospital at Omaha where she was delivered by Dr. Gerald H. Beck, whose report follows:

"Examination revealed first child in left sacro-posterior position, buttocks well down on perineum, cervix effaced. The buttocks and scrotum of this child could be palpated. The bag of waters had ruptured. Delivery of frank breach with anterior rotation was done. Hyperactivity of the second child could be plainly discerned. The second

[1] Read before the Nebraska Iowa Pediatric Society, January, 1922.

child was delivered by podalic version. There was a slight mucous tear of the perineum, but repair was unnecessary. The placenta was about one and a half times larger than normal, somewhat oval in shape, and had one chorion with two amniotic sacs evenly dividing the placenta, which had a cord attached to each end of the [illegible]. The first child weighed at birth [illegible] pounds [illegible] and the second child 6 pounds, 1/8 ounce."

Examination of these twins revealed the following startling facts: *They were born of the same sex, the color of the eyes was the same in both; the color of the hair was identical,* and *the crown whirls were in opposite directions.* A complete [illegible] palate and double harelip was present in [illegible]. *In spite of these deformities, the similarity of appearance was striking.* In all other respects they were normal and apparently healthy.

The subject of twinning has always been one of great interest, and, together with the many associated problems, has stimulated the development of a very extensive literature. Two types of human twins are now recognized, viz.: those derived from two fertilized ova, dizygotic, and those developing from a single fertilized ovum, monozygotic. The former, while interesting from the standpoint of double ovulation and growth in a uterus illy adapted to multiple pregnancy, are no more closely related than other brothers and sisters of widely diverging ages. On the other hand, monozygotic twins present the extremely interesting problem of the possible factors and forces which cause two separate individuals to spring from a common cell. It has been thought that both share in the same hereditary factors; hence the term "identical" twins. The description given seems to place this pair of twins in the monozygotic type. An extended statistical study by J. B. Nichols (8) leads to the conclusion that about one-fourth of all human twins are monozygotic. It is, of course, admitted that such work can only be inferential, and that in order to settle the question absolutely, it would be necessary to establish the presence of a single corpus luteum in multiple birth. I have been unable to find a report of any observations on this point, which might easily be settled by studying the ovaries during a cæsarean operation for twins.

The relation of twins to placenta and membranes was studied by O. Schultze and commented on by H. H. Wilder (9). He concludes that cases like ours in which there is a single chorion and decidua surrounding two amniotic sacs with two umbilical cords are most probably cases in which a single fertilized ovum has developed two embryonic areas on a single blastodermic vesicle.

Extensive study of polyembryony has shown that in lower forms as well as in mammals, all individuals developing from a single egg have the same sex, to wit: caterpillars, when several hundred larvæ develop from a single egg. C. H. Danforth (10) made a study of the family connections in fifty pairs of twins in order to determine whether or not twinning is hereditary. He came to the conclusion that it has an hereditary basis but he was unable to find any law governing it.

Particular interest centers around the question of variation and heredity in monozygotic twins. With our present conception of transmission of heritable characters, "identical" twins must have in the beginning a single set of factors. If the two individuals vary it must be due to an unequal distribution of these heredity factors. The identity of such common heredity is characterized by the sameness of sex and the remarkable similarities of appearance so commonly seen in twins. That these points of similarity comprise more minute details was beautifully brought out by Wilder (11), who showed that finger prints were alike and that mirror imaging occurred with great frequency.

F. Sano (12) found that in the brains of "identical" twins the convolution patterns were strikingly similar. He also found that the crown whirls were on opposite sides of the median line, thus repeating the mirror imaging which Wilder found in the finger prints.

Bateson (13) has suggested that mirror imaging is evidence of symmetrical patterns. If it can be proved that finger prints and convolution patterns are heritable characters it will go far toward confirming Bateson's suggestion. It has long been recognized that such characters as eye and hair color are shared by both individuals. In our case the question arises whether or not cleft palate is an heritable character; then, if so, it must be shared equally by both twins. Following Bateson's suggestion, we must visualize

twins as representing symmetrical halves, just as we visualize symmetrical halves in the single born individual. Bilateral asymmetry in an individual is not unknown, and even cases in which the two eyes are of different colors have been reported. In such individuals we must assume that the differentiating factors have not been equally distributed to the two sides hence, asymmetry. The appearance of the same character in monozygotic twins depends then on an equal distribution of the determining factors to the two cell masses in the earliest cleavage. It seems conceivable that one early embryonal mass may receive a differentiating factor while the other does not; hence both would not only *not* have the somatic expression of the character in question, but only one of them would have the power of transmitting it. This accounts for the occasional asymmetry observed in "identical" twins.

Cleft palate and harelip are widely distributed congenital deformities, being more numerous in China, where they are still looked upon as marks of beauty, and rarest among the peoples of the South Sea Islands. Cleft palate is, as the name implies, a congenital cleft of the palate due to a lack of union of parts. Truman W. Brophy (1), in defining cleft palate, says: "The deformity, the statement of many authors to the contrary notwithstanding, is *not* the *result of defective formation in the palatine plates, nor congenital deficiencies of the parts in question, nor arrested growth of the palate, nor absence of a portion of the palatine tissue.* All children who have congenital cleft palate, with rare exceptions, have, in the palate at birth, the normal amount of tissue, although it is not united in the mid-line." Harelip is a congenital fissure or fissures in the upper lip due to failure of the superior maxillary and premaxillary processes to unite with each other in early embryonal life. The morphological explanation lies in the fact that there is a failure of union between the process globularis and the maxillary process, by which non-union the original connection of the oral sinus with the nasal pits is retained. Cleft palate and harelip occur singly but are frequently seen together. In classifying cleft palate, Professor Arthur Keith (14) quotes Gustaf Haug's (15) series, in which tripartite palate occurred in 15 per cent of cases, while in the London series there was 38 per cent. In the bipartite type the percentages were 22 and 23 respectively. In the case here reported we are dealing with the most severe form, the tripartite cleft palate. The premaxillary bone protruded and was separated by lateral fissures from each of the maxillary bones but joined the vomer. The case was further complicated by double harelip in both children.

The etiology of harelip is very closely associated with that of cleft palate. The predisposing causes, according to Brophy (1), are heredity and the presence of supernumerary teeth, or possibly intervening mucosa, preventing the submucous tissues from uniting. The exciting causes are undue pressure on the palato-alveolar inclined planes of the ununited maxillary bones, position of the fœtus *in utero*, malnutrition, etc. R. Clement Lucas (16) advances the theory that congenital absence or illy developed upper lateral incisors may be a forerunner or the first sign of an hereditary tendency leading in later generations to the formation of cleft palate and harelip. Professor Warnekros (17) argues for the theory of supernumerary teeth as a factor in the etiology of cleft palate by showing the tendency in cleft palate families to the development of supernumerary teeth. Prenatal impressions are oftentimes given as a lay cause of the deformities, but the time of the occurrence of such impressions is usually long after union of the bones is completed. Malnutrition and heredity are considered important factors in the etiology of these deformities. Uterine disease, syphilis, etc., especially during the early months of gestation, are influences not to be disregarded. All recent experimental work points to maldevelopment as a result of injury to the embryo. Such effects are selective only in so far as they tend to affect the part growing most actively at the time of the injury. And the results of a given injury on a large number of embryos of the same age are alike only in a broad way—not identical. It seems very unlikely that any injury would have affected these twins in an identical manner. However,

for every inherited character there is a germinal cause in the fertilized ovum. An inherited character is not to be thought of as the result of a single cause nor as the product of a single determiner. Whether the inherited character develops at all or not seems to be due to the presence or absence of one or more determining factors, but if these factors exist, the degree of development may be influenced by many subsidiary factors or modifiers (18). These subsidiary factors, transmitted independently of either the main factors or of one another, may be present in an individual who lacks the main determining factors, yet this individual may beget offspring from one who carries the main factors without the modifiers.

It is a well-established biological fact that an hereditary character, determined by some particular combination of inheritance units, by the union of the two parental cells is transmitted to the gamete.

Delayed dominance of character is well known in the color of hair and eyes of children, although dominance may become complete when adult life is reached.

When dominant and recessive characters appear in any zygote, the factors which determine these characters may exist in every cell of the organism throughout one generation, and yet there may be more or less complete separation of these characters in the next generation. This makes possible recombinations of physical entities and instabilities of types which under our present system of marriage and eugenics leads to the perpetuation of undesirable characters. No doubt this recombining of physical entities through separation of dominant and recessive characters plays an important rôle in the etiology of cleft palate and harelip, for one generation may be entirely free from the deformity, only to have it reappear in succeeding generations. Family trees of cleft palate and harelip cases show that, if heritable, it follows no known law, but may affect an entire family, a few, or even single individuals. It is well known that the greatest number are afflicted when both parents either have a family history of cleft palate or are themselves affected. W. L. Shearer (2) reports a positive family history in 95 per cent of over one thousand cases.

marked resemblance in spite of deformity.

Malnutrition plays such an important part in developmental anomalies that it may be a very important factor in the failure of union in the palate processes, as advanced by M. H. Cryer (19). If union does not occur when the bones are in contact during the fifth and sixth weeks of fœtal life, growth in the several elements of the palate, together with pressure from the surrounding parts, causes them to be separated from each other more and more as growth proceeds.

J. S. Foote (20), in studying cross sections of femurs in normal and cleft palate infants, reached the conclusion that cleft palate is a local evidence of a block in the development of the osseous system, due possibly to some disturbing factor such as the thymus. He found that bone development in a cleft palate infant at full term approximates that of a 4½ months fœtus.

In speaking of malnutrition as a possible etiological factor in cleft palate, Brophy (1 cites an interesting experiment carried out in the zoological gardens in Berlin. Of thirty-two jaguars, born of the same mother and the same sire within one year, all had cleft palates and died. At that time the jaguars were fed constantly on cold meat from which the blood had been allowed to escape. Later they were fed meat which was still warm and which contained blood, and out of twenty-five animals born, not one had a cleft. This seems difficult to bring into harmony with the theory of heredity. Yet it is known that if the larvæ of bees are fed upon "royal jelly"

which is rich in fats, they become fertile females or queens; if fed upon "bee bread" they become non fertile females or workers. There are marked morphological differences between the workers and the queens, but even more striking differences in instincts and habits. All of these differences, whether in bodily structure or instincts, are determined by the character of the food and not by heredity. A recent article (25) on rachitis in children, which is supposedly purely a disease due to insufficient or improper diet, claims that a cure may be effected by exposure to sunlight or repeated exposure to non-toxic rays of the ultra-violet light. Is it any wonder that the etiology of cleft palate and harelip is as yet unsettled?

Other theories must also receive mention. In the formation of the teeth, the mucosa dips deeply down into the submucosa, forming the epithelial lamina which later contracts into the epithelial cord, from the distal end of which the enamel organ arises. This intervening layer of epithelium, together with the force exerted by the tongue and mandible upon the palate, with the body of the fœtus in the flexed position and the masticatory muscles active, may influence non-union. This is the theory advanced by C. W. F. Boedecker, of Berlin, and accepted by Brophy to be the best explanation yet given for cleft palate.

In discussing congenital malformations of the palate, Professor Arthur Keith (14), describing the union of the premaxillary bone with the lateral maxillæ during the amphibion stage of the embryo (fifth to sixth week), and that of the palate process in the mammalian stage (seventh to eighth week), called attention to the irregularity of growth of the several parts, but stated that the irregularity of growth is not the cause but the result of the cleft.

In tracing the earliest stages of the evolution of the face, we find that its apertures and cavities provide for contact of the central nervous system and alimentary tract with the outside world. The first step in differentiation occurs on the twelfth day, when the oral plate, consisting of a small area of ectoderm and entoderm, appears on the ventral surface of the head end of the embryo. Adjacent tissues grow upward, depressing the oral plate and forming the oral pit, the original oral plate becoming a part of the pharyngeal membrane. During the third week the first (22) and second visceral arches appear, the first dividing shortly after into the mandibular arch and the maxillary process, both of which grow toward the median line of the ventral surface of the embryo. By the sharp flexion of the head and neck, which occurs about the twenty-second day, and by the continued mesial growth of the mandibular arches and maxillary processes, the oral pit deepens and acquires more definite boundaries. By this time a thickening on the ventral wall of the forebrain vesicle has occurred at the upper margin of the oral pit. This thickened area becomes the unpaired nasofrontal process, on each side of which are seen the widely separated nasal pits in contact with the forebrain vesicle. During the fifth week the nasofrontal process thickens laterally to form the globular process and the inner boundaries of the nasal pits. Two ridges grow downward and forward from the nasofrontal process to form the outer boundaries of the nasal pits. These are the lateral frontal processes, and by their growth the nasal pits deepen and separate from the maxillary processes, but still retain their communication with the primitive oral cavity. The mandibular arches unite mesially at about the thirty-fourth day. A failure of union in the mid-line of the mandibular arches produces the deformity known as "aprosopia." At this time the tongue projects upward between the ununited halves of the maxillary processes and almost completely fills the mouth. It is to be emphasized that the position of the child *in utero* is such that the weight of the entire body is thrown upon the vertex, that the masticatory muscles are active and that the extreme flexion of the head and neck, with the tongue wedged in between the lateral halves of the maxillæ, tends to force the mandible, which is now united, into contact with the sternal region, and this forces the forming jaws together. If, now, undue pressure occurs or there is a remnant of epithelium intervening, or if there exists a state of malnutrition

causing a delay in ossification and growth, or if there be any combination of these factors, it is conceivable that a permanent cleft may result. If one bears in mind that part of the bones entering into the makeup of the palate belongs to the visceral arch skeleton and the other develops in the membranous wall of the cranial capsule, it is obvious that complications may arise from any of the above-named causes more easily than if all the bones developed from the same sources. There is, however, some controversy in the literature relative to the ossification of bones forming the palate. The maxillæ develop from the skeletal system, and their centers of ossification seem to vary in number according to the different authorities. The following is a list (22) which includes the centers of ossification for the premaxillæ:

One center: Camper, Cleland, Rosseau.

Two centers: Jamain, Mall.

Three centers: Serred, Meckel, Cruveilhier.

Five centers: Béclard, Sappey, Leidy, Poirier, Krause.

Six centers: Portla, Rambaud, Renault.

Seven centers: Weber.

According to Gauppe (1906), small cartilaginous islands appear in the alveolar process in the fourth to fifth months. These have no connection with the nasal capsule, and disappear during ossification of the upper jaw. This may account for the above diversified opinions. Franklin Mall (1906), claims that the maxillæ develop in two distinct parts, a medial (premaxilla), and lateral.

Each ossifies from a single center, which appears at the end of the sixth week and becomes united at the end of the second or early in the third month. Each of these centers gives rise to a part of the frontal process. The alveolar borders of the two bones unite before the frontal processes. At first the maxillæ lie lateral to the cartilaginous nasal capsule. Later this cartilaginous capsule is, to a large extent, absorbed, as a result of which the maxillæ help to bound the nasal cavity. To it becomes joined the *maxillo turbinale*, closing off some of the ethmoid cells, and the sinus maxillaris is formed. The formation of the alveolar process begins in the fourth fœtal month, and is completed after the twentieth year. Albrecht calls attention to a possibility of double centers of ossification for each premaxilla, which might explain a central cleft of the palate.

The palate bones (23) commence ossification in the vertical plate in embryos about the nineteenth millimeter stage, eighth week. It is a membranous ossification and begins at the side of the nasal cavity immediately internal to the palatine nerves. The orbital and sphenoidal processes are outgrowths of the vertical plate. The vomer arises from a bilaterally placed pair of nuclei which appear during the eighth week, near the back of the inferior margin of the cartilaginous nasal septum, but superiorly they extend on each side of the septum so as to enclose the septum between two thin plates of bone. These two plates gradually fuse from behind forward, but union is not complete until the age of puberty. Although the vomer develops on each side of the cartilaginous nasal septum and at its expense, it is regarded as a true membranous bone. This gives approximately six ossification centers in the formation of the palate.

CONCLUSIONS

1. This pair of twins belongs in the class of monozygotic twins.

2. Cleft palate results from non-union of parts, and at birth with rare exceptions the amount of tissue present is normal.

3. The etiology of cleft palate and harelip is not yet settled.

4. Heredity and malnutrition as causative factors, while of interest, are contradictory.

5. Embryonal development of cleft palate proceeds in the normal manner except for non-union of parts.

6. The number of ossification centers entering into the formation of the palate is still in dispute but is probably represented by two palatal, two maxillary, and two premaxillary centers.

7. All individuals have potential cleft palates until the third month of embryonal life is passed.

8. The mandibular arches unite prior to the maxillary processes and may prevent union of the maxillary processes by flexion of the chin on the sternum, causing pressure

on the palato-alveolar inclined planes of the ununited maxillæ.

9. I have been unable to find in the literature a case of tripartite cleft palate in "identical" twins.

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PELVIC TUMORS WITH SACRAL ATTACHMENTS

[illegible]

PELVIC tumors with sacral attachments, or "Ventral Tumors of the Sacrum," as we designated them in a paper read before the Western Surgical Association in 1912, are so rare that a careful study of the literature has shown but 30 of these cases reported. This includes the 2 cases here presented.

When we study the embryology of the sacrococcygeal region we appreciate why certain tumors whose occurrence is rare in other locations may readily be found here, tumors which exhibit one or all of the three primary germinal layers.

We learn that very early in the life of the embryo, the caudal intestine, the canal dorsalis, the chordæ dorsalis, primitive streak, medullary tube and vestiges, are formed in the caudal end of the spinal axis by the entoderm, mesoderm, and ectoderm.

We find as well that the central canal of the spinal cord and the primitive alimentary canal are in communication around the notochord as the neurenteric canal.

When the proctodeum invaginates and finally forms an opening into the primitive gut, this opening occurs anterior to the neurenteric canal. Thereby there is left a small portion of the gut between the newly formed anus and the neurenteric canal, the so-called "postanal gut": this hind gut and the communicating neurenteric canal finally become obliterated and are then designated as "obsolete canals."

An understanding of the embryology of this complex region lucidly explains the multiple types of tissue which enter into fetal vestiges remaining ventral to the sacrum, and the wonder is not that tumors are found here so rarely, but rather that they are not of much more frequent occurrence.

These tumors ventral to the sacrum exhibit such a great variety of tissues, which are sometimes hard to differentiate, that they come under the classification of dermoids, mixed tumors, or the teratomata; in addition to these we must add the very rare chordoma, arising from the anlage of the notochord, for 6 cases of this type of tumor have been reported attached to and in front of the sacrum.

Uncertainty as to the etiology of these tumors is responsible for the many theories advanced by various observers who have at-

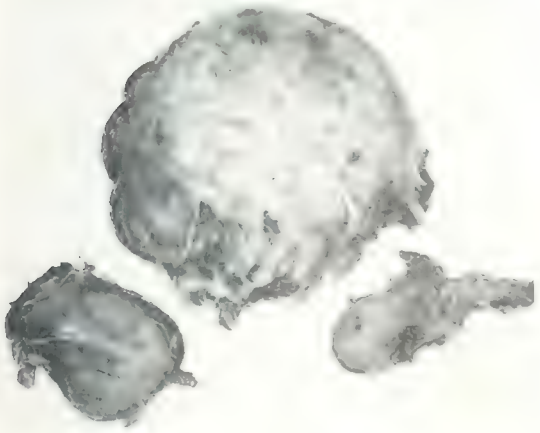


Fig. 1. Case 1. Gross specimen.

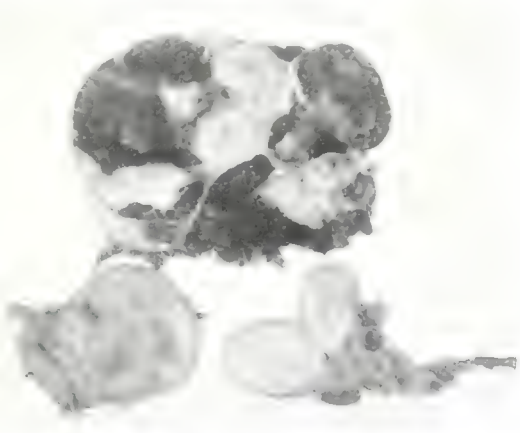


Fig. 2. Case 2. Tumor [illegible]

Read before the Southern Surgical Association, December, 1913, [illegible]

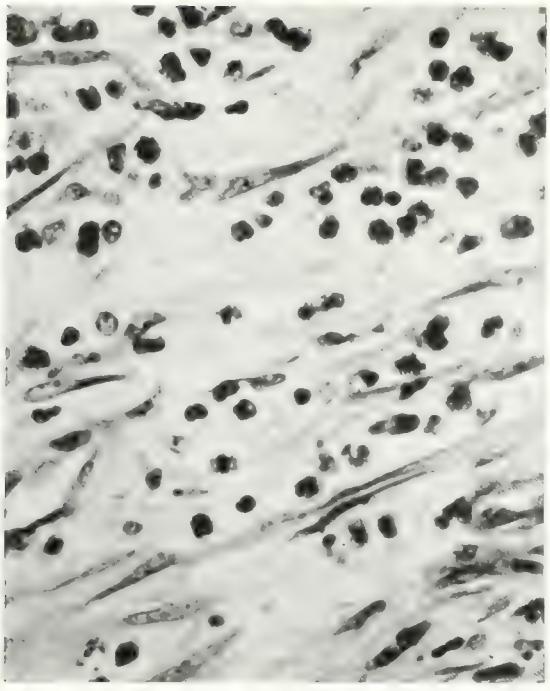


Fig. 3. Case 1. Area in large tumor showing stroma infiltrated by eosinophiles. 250×.

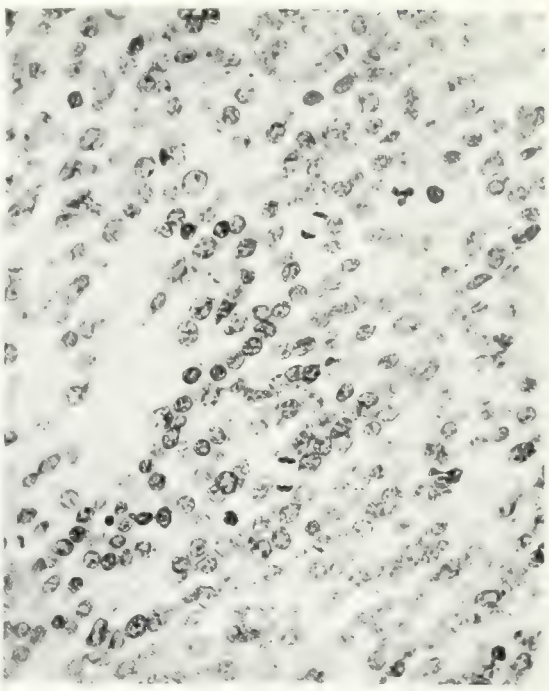


Fig. 4. Case 1. High power view of embryonic cells in large tumor. Note mitoses and variations in size of nuclei. 250×.

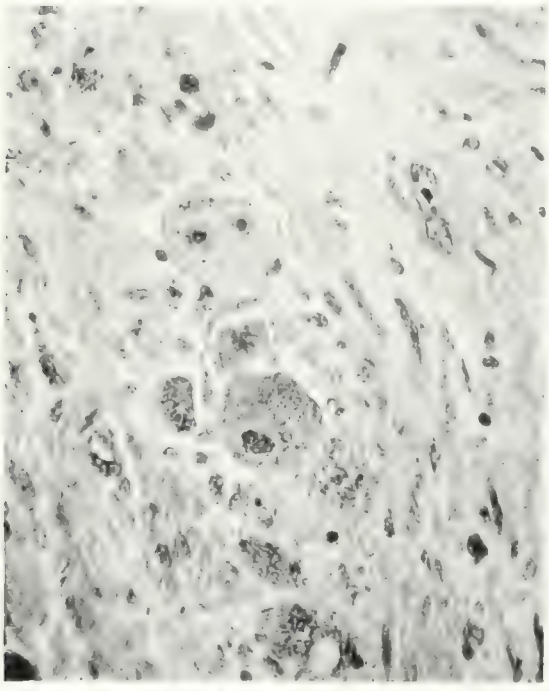


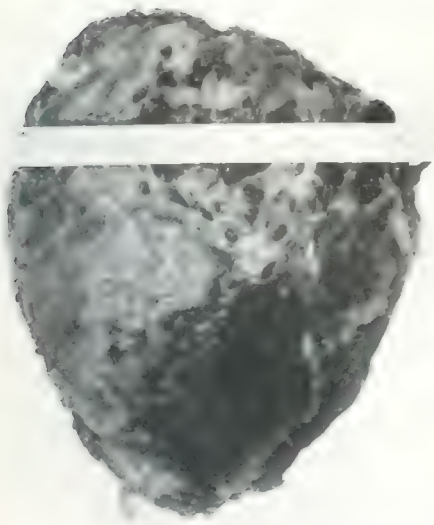
Fig. 5. Case 1. High power view of ganglion-like cells in small tumor. Note pigment and double nuclei. 500×.

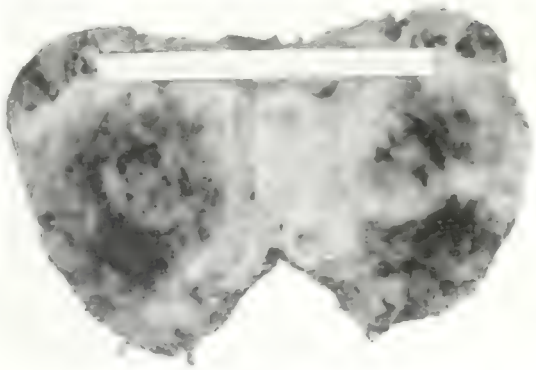
tempted to explain their origin. The March-and-Bonnet theory has accorded a genetic equality to all composite dermoids, embryos, and parasites.

Borst asserts that disturbances in the caudal region may make it possible for portions of the vestiges coccygiens to be transplanted to the ventral side of the sacrum, and there give rise to the tumors.

Middledorpf, Ritsch and Masse, believed these tumors arose from local disturbances of development of misplaced tissue anlage of the postanal gut, medullary canal and neurenteric canal, in conjunction with ectodermal and mesodermal inclusions.

Virchow, Ahlfeld, and Henning found it difficult to accept the monogerminal theory as explanation of the complex teratomata where were found fragments of organs, bone, or fœtal limbs. This skepticism gave rise to the bigerminal theory, which postulates that these tumors represent an incomplete monstrosity or twin, a parasite engrafted upon its host, a so-called suppressed fœtus.





but one germinal layer, to tumors representing nearly all types of tissue: in some of them the tissues are difficult or impossible of differentiation, while in others a preponderance of one type of tissue identifies them, as instanced by the notochord tumors with the typical vacuolized cells suspended in a gelatinous matrix, or in the very rare tumors where ganglionic cells or neuraxones have been demonstrated and uphold the theory of neurenteric canal origin.

Another theory advanced, although not generally accepted, is, that the tumors with their three embryonic layers are originated by a blastomere or impregnated pole cell which has been cast out of the complex.

Adami has advanced an ingenious theory, derived from his observations on the growing points of plants, where in the root and stalk the cells of the growing points are projected and crowded apart by the division of the daughter cells between them.

In the mammal he believes these growing points are located at the base of the brain, near the pituitary body, and in the region of the sacrum.

He affirms that with the complete development of the nervous system, further development of the growing points is arrested. If then, through some exciting agent, the growth continues after the mammal has reached maturity, he believes the cells have the peculiar property of reproducing the three primary germinal layers: this theory Adami claims will explain the etiology of the teratomata and mixed tumors which occur at the base of the skull and in the sacral region.

These pelvic tumors ventral to the sacrum vary markedly in their morphology, ranging from the simpler inclusion dermoids showing

Most of the tumors under discussion have been reported to be definitely encapsulated and were readily shelled off from the sacrum.

They have been confused with all of the pelvic neoplasms, including fibroid tumors of the uterus, ovarian cysts, tubal and abdominal pregnancies, abscesses, intraligamentous cysts, anterior spina bifida and hypertrophied prostate.

They have generally been considered benign, yet Parin collected 6 cases which proved to be malignant, and Pringle, Fowler, and Lund report local recurrence and metastasis. Both of my cases died of recurrence.

Eighty per cent of the chordomata have been reported to be malignant.

These tumors are rarely recognized until they encroach upon neighboring organs the uterus, bowel, or bladder, exhibiting symptoms of pressure or obstruction.

While they are easily palpated by rectum or vagina, their differentiation is sometimes very difficult. This explains the attempts to remove them by the abdominal route, a

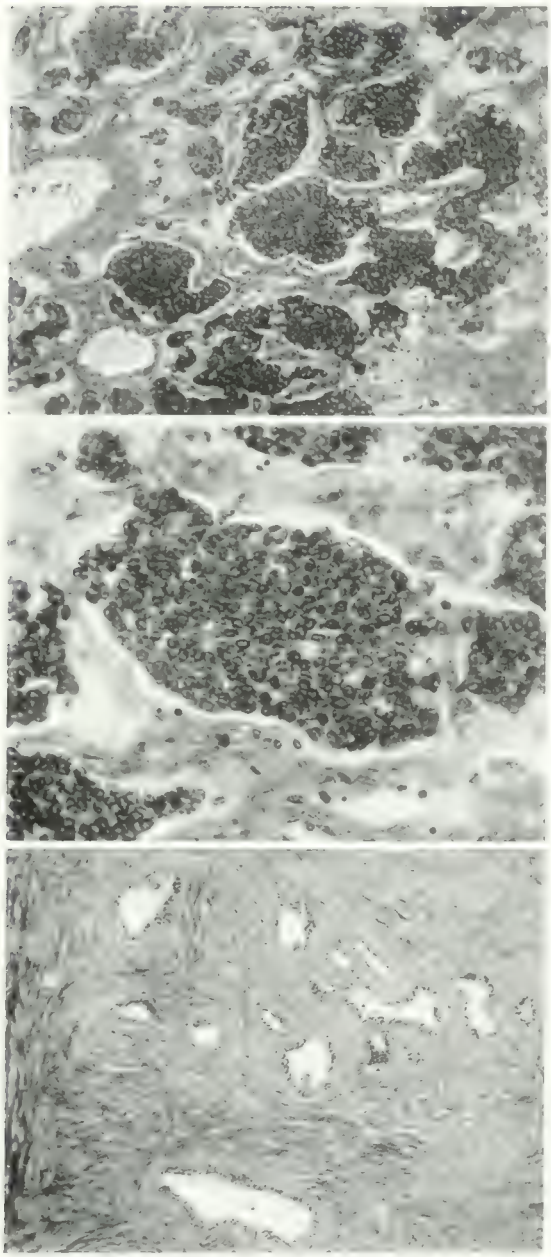


Fig. 8 (at top). Case 2. Low power view of a typical area. The cellular cords anastomose freely and are separated by loose fibrous connective tissue.

Fig. 9 (middle). Case 2. High power photomicrograph of area in Figure 8.

Fig. 10 (below). Case 2. Photomicrograph of area of tumor showing glandular alveoli which are separated by dense stroma containing bundles of smooth muscle. This structure is identified as prostatic tissue.

difficult and dangerous method owing to their inaccessibility and the difficulty of controlling hæmorrhage.

We believe that owing to the demonstrated tendency to malignant degeneration, these tumors should be removed when recognized, and we are convinced that they should always be attacked from behind through the sacrococcygeal route. The modified Kraske approach is ideal for the larger tumors; it permits them to be shelled out with little difficulty, usually without invading the peritoneum, and facilitates the control of hæmorrhage.

Because of the rareness of this tumor, and because the histological structures vary so markedly, we are constrained to report two cases which have occurred in our experience. The first case was reported in 1912, and therefore will be briefly abstracted.

Case 1. Miss M. B., age 16, pregnant and at full term. Was in active labor for 24 hours. There had been no engagement of the head. Bimanual examination revealed a pelvic tumor which was thought to be a fibroid in the posterior cervical lip. This growth prevented delivery *per vaginam*. On August 28, 1912, a cæsarean section was done and the child delivered. Through the abdominal incision we were enabled to determine that this tumor was attached to the sacrum and could not be removed by this abdominal route.

On October 2, 1912, as this woman was cachetic, she had a low hæmoglobin and the tumor was rapidly increasing in size, she was subjected to an exploration. The exposure was made through the sacrum by a typical Kraske incision. The tumor was found to be retroperitoneal with a small attachment to the sacral periosteum, and crowding the vagina and rectum. It was removed with little difficulty. The patient was discharged from the hospital 5 weeks later.

Dr. H. E. Robertson, now professor of pathology in the Mayo Clinic, in a careful study of this unusual tumor reported it at length. The tumor was 9 centimeters in length and 6 centimeters in diameter, and definitely encapsulated. There was a smaller tumor attached to the main tumor 3.5 centimeters in diameter. In the study of these tumors Dr. Robertson's conclusions were as follows:

"The large tumor shows a loose, rapidly growing connective-tissue stroma in which are nests of embryonic cells growing in syncytial-like masses and suggesting malignancy in their manner of growth and appearance. Areas of hæmorrhage, necrosis, and calcareous degeneration demonstrate the atypical character of the tissue, its rapid development and imperfect blood supply

"The smaller tumor suggests a neuroma in its general character, although neuroglia fibrils have not been demonstrated

"That the tumor springs from some misplaced remnants of the terminal portion of the renal tube seems a logical conclusion. That portions of it have developed abnormal powers of proliferation and shown signs of malignant change while other portions have in an imperfect manner reproduced the adult type of nerve tissue, is apparently the only explanation which accounts for these rather widely diversified tumor masses."

It is interesting to note Dr. Robertson's original observation as to the malignant characteristics of the tumor. This patient died a year later in the country from a local recurrence. The tumor masses removed by the local physician and sent to the University of Minnesota for examination, reveal the following:

"Microscopically, the tumor is composed of small irregular masses and cords of cells separated by a large amount of loose fibrous stroma in which there is a considerable amount of diffuse hæmorrhage. The cords are composed of loosely stained cells embedded in a common cytoplasmic mass, that is, there is rarely a definitely outlined cell body. No nerve cells such as occurred in the primary tumor can be identified.

Diagnosis: Recurrence of malignant neuroblastoma."

Case 2. E. T., male, age 27. The difficulty was first noted 4 months ago when the patient noticed pain in the rectal region and some degree of constipation. No blood was passed by rectum. He had no hæmorrhoids. He found some slight difficulty in urinating. There was no loss of weight. He was told he had a fissure *in ano*.

Examination March 5, 1921. Well-nourished boy with no abnormality other than the local condition. Rectal examination revealed a hard, smooth, rounded mass, almost completely filling the true pelvis. The mass was not tender and could not be differentiated from the prostate. The bladder was readily catheterized.

X-ray examination showed a normal sacrum and coccyx. X-ray of the bladder filled with sodium bromide solution revealed this viscus pushed upward out of the true pelvis and lying in close apposition to the anterior abdominal wall. No irregularity in the contour of the bladder could be demonstrated by the X-rays.

Under gas anæsthesia this mass was explored with a hollow needle but with a resultant dry tap.

Clinical diagnosis: Ventral tumor of the sacrum.

Operation March 15, 1921, at the Northwestern Hospital. Under gas and ether anæsthesia, the mass was approached by a modified Kraske incision, removing the coccyx and the sacrum below the third foramina. The mass was found definitely encapsulated, the capsule being roughly about one-fourth of an inch in thickness. The tumor was attached to the hollow of the sacrum. The prostate gland was not seen or felt during the operation. The gut lay anterior and to the left of the mass. The tumor was shelled out with relatively little hæmorrhage.

The patient was [illegible] and in comparatively good condition. The wound healed by primary union and he was discharged [illegible] months later on June 5, 1921, at which time his pelvis was completely filled with the tumor mass. It was impossible to get a complete examination as pathology to the tissues removed from the pelvis. The report of the primary tumor sent in by the resident [illegible] pathology, University of Minnesota Medical School, is as follows:

"Microscopically the structure of this tumor varies in different portions. The most common appearance is a network of thick anastomosing cords of cells which are separated by a small amount of dense fibrous connective tissue. The cords are composed of closely packed, slightly [illegible] cells imbedded in a common mass of cytoplasm without the formation of any definite cell. There is no differentiation into recognizable tissue. The appearance of the tissue suggests an epithelial character.

Other areas of the tumor show much more abundant connective tissue with a corresponding [illegible] of the epithelial cords. In some places the cords are broken up into small masses separated by large amounts of connective tissue. The structure of the cords of cells is everywhere, however, the same.

One small portion on the margin of the tumor shows definite prostatic tissue. The surgeon does not report the tumor as attached to the prostate. The prostate tissue is encapsulated. The presence of this tissue suggests the possibility of the tumor having its origin from the prostate gland. If this interpretation be correct, we are dealing with a malignant prostatic tumor, apparently of epithelial nature.

The recurrence shows a structure similar to that of the original tumor except that no prostatic tissues are found."

The interesting feature of this tumor is that there is only one tissue in it which can be definitely differentiated, and this tissue is prostatic tissue. This tissue suggests the interesting possibility that this tumor may represent an embryoma bearing the same relation to the prostate as do some of these tumors of the testicle to that organ, and that it might possibly be classed as a teratoma of the prostate in which development was one-sided. We are, however, unable to find any reference in the literature which substantiates such an assumption.

Inasmuch as it has been impossible definitely to differentiate this tumor, it is not important

by what name we designate it, so long as we recognize that we are dealing with an embryoma of malignant tendencies. Therefore, the writer has stressed the importance of the removal of these embryonic tumors ventral to the sacrum, as he believes that most of them tend to malignant degeneration.

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SUPERNUMERARY KIDNEY WITH URETER OPENING INTO VAGINA

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[illegible]
HOWARD KERN, M.D.
[illegible]
and
LOUIS SACHS, M.D.
[illegible]

PROBABLY the kidney is more frequently congenitally malformed than any other organ in the body. Under the heading of malformation many varieties are seen. Gerard, in 1905, made a study of the world's literature and found 527 cases of renal anomalies. Dorland, in 1911, collected from the literature from 1898 to 1910, 123 cases of renal anomalies. Both practically arrived at the same conclusions as to the frequency the following anomalies are found: horseshoe kidney, in 25 per cent; rudimentary kidney, in 9 per cent; absence on one side, in 15 per cent; displaced kidney one or both in the pelvis, 16 per cent; supernumerary kidney, 4 per cent

Kretschmer, in 1915, reported an undoubted case of supernumerary kidney. He quoted cases from Sutter, who tabulated 19 cases. Sutter's cases are probably double kidneys. All are agreed that true supernumerary kidney is the rarest of all malformations. To accept a kidney as supernumerary, it must be a separate kidney enclosed in its own capsule, either lying free from the other kidney, or attached to it, having its own blood supply, pelvis, and ureter. Its ureter may anastomose with another ureter, or enter the bladder, giving a third ureteral opening; or the third ureter may open and drain the supernumerary kidney outside of the body, or into the vagina or rectum.

Our case is unique in that a duplicate of it cannot be found in the world's literature. The ureter in our case, as will be described in full later, did not anastomose with another ureter, but passed directly downward and opened into the vagina, near the cervix giving rise to a uretrovaginal fistula.

A brief review of the embryology of the kidney and ureter will explain in a measure how the anomalies of the upper and lower urinary tract may arise.

EMBRYOLOGY

In the development of the kidney, we are concerned with the growth of three definite and distinct organs, which are formed at different stages in the growth of the embryo. These organs are known as the pronephros, the mesonephros, and the metanephros. The first two degenerate, while the third remains the permanent kidney. It so happens that the second begins to develop when the first degenerates, and the third begins to develop, as the second degenerates, so that a constructive and a destructive process is going on at the same time. The pronephros carries on an excretory function during its existence. It is thought that the mesonephros exercises a similar function and does form the beginning of the metanephros and the reproductive apparatus. The metanephros goes on to complete development and is the active excretory organ.

The metanephros may be divided embryologically into two portions, the secretory glandular portion and the efferent apparatus. From the latter develops the ureter, the renal pelvis and the collecting tubule system. The anlage of the ureter arises as a hemispherical outgrowth of the primary excretory duct. The short ureter grows at first dorsally, later cranially, and when it gains the dorsal surface of the mesonephros radical outgrowth of the collecting tubules takes place. While the ureter is still in a period of outgrowth, the primitive pelvis elongates in a craniocaudal direction and thus acquires

Fig. 1. Lower pelvic region showing 2 catheters and beginning of dilated ureter.

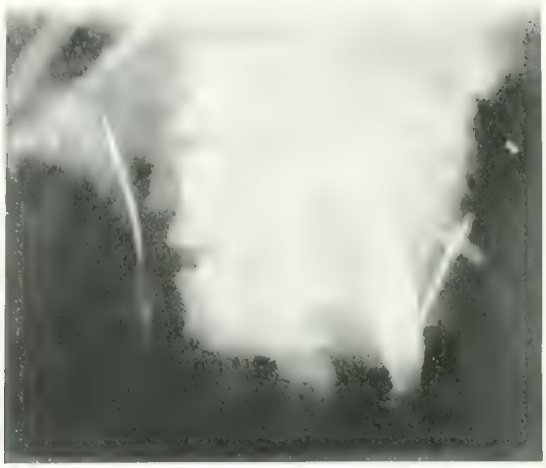

Fig. 2. Pyelogram showing 3 small calyces at end of dilated ureter. Right kidney not injected. Catheters in left kidney and right kidney

its poles. The secretory glandular portion of the metanephros is derived from a group of cells known as the metanephrogenic tissue which accompanies the ureter in its ascent and which always covers the primitive renal pelvis. The tissue breaks up to form collecting tubules.

There may be an absence of one or both kidneys. In such a case the anlage of one or both fails to bud off from the excretory duct, or if the anlage were formed it was either arrested or absorbed in the early course of its development. Absence of the ureter and maldevelopment of the reproductive organs may result. If the renal bud sprouts early or if the division takes place at different points, and if each division is surrounded by an independent mesochyme, there would be a double secondary anlage for the kidney. These anlagen are usually placed one above the other. They either remain distinctly separate throughout the period of their growth, forming two kidneys, on one or both sides The supernumerary kidney may be accounted for in this way. They may fuse at some time during their course of development, forming one kidney on each side, or both sides may fuse, forming a large mass of kidney tissue.

The blood supply to the buds determines the ultimate size of the kidneys. If there is a lessened blood supply to either bud, the bud fails to grow at the same rate as the bud with a greater supply, resulting in a rudimentary kidney. In our case of the accessory kidney, the blood supply was separate and distinct. The artery coming off from the aorta at a higher level than the artery supplying the larger kidney. The artery was very much smaller. The vein was single and did not divide at the pelvis.

Changes in the ureter. Abnormalities of the ureter are dependent upon the renal bud, while anomalies of the kidneys result in abnormal development of the mesochyme. Abnormalities of the ureters may be divided into two classes: the incomplete double ureter, and the complete double ureter. In the former, the ureter has a common opening in the bladder, and in the latter each ureter has its own separate opening. If the renal bud divides too early or if the division extends into the ureter segment, the splitting formed in the ureter itself may remain here permanently and any variation might exist, from exaggeration of the upper and lower pelvis to an incomplete reduplication.

If the splitting of the renal bud is so complete, that it is affected by the shortening of the segment of the wollfian duct, lying between it and the cloaca, it is possible

Fig. 3. Pyelogram shows right kidney and ureter. Dilated ureter on right side. Roentgenographic catheter in left side.

Fig. 4. Posterolateral view of gross specimen. Capsule removed at upper part to show pelvis; subcutaneous connective tissue at upper part of specimen. Lower rounded part of specimen is point of attachment of supernumerary kidney to upper pole of right kidney.

for each division to acquire a distinct orifice in the duct, resulting in a double ureter. In complete double ureter, the ureter from the upper surface has a lower orifice in the bladder, lying somewhere between the higher opening of the dorsal ureter and the opening in the genital duct.

Our patient was referred by Dr. E. Leopold, with the history that she has been having a vaginal leakage of urine, from as far back as she could remember. Some eight to ten years ago she had an operation performed for the leakage, which was unsuccessful. The patient was sent to Hebrew Hospital for a cystoscopic examination.

Y. G., age 29, single, seamstress, entered the Hebrew Hospital March 20, 1922, complaining of dripping from the vagina.

Present illness. As far back as patient can remember there has been a constant leakage of urine from the vagina, both nocturnal and diurnal necessitating the wearing of a vulval pad. In addition the patient stated that she voids normally from the urethra with frequency at times, voiding more often after sitting down than when on her feet. There is no polydypsia, no pruritus. During the past 18 months there has been more discomfort than formerly. In 1907 patient was operated on. A plastic operation was done for vesicovaginal fistula. The operation, however, proved to be of no benefit to patient. Believing her condition to be incurable the patient made no further effort to secure relief.

Previous history. Patient has always enjoyed fairly good health. Had measles in childhood, rather frequent frontal headaches, submucous resection for frequent "colds," some palpitation and dyspnœa on exertion.

Genito-urinary, negative; menstrual history, normal; habits, unessential; accidents, none.

Family history, unessential.

Physical examination. General physical examination shows a well developed, well nourished woman, with negative physical findings, except for the following: There is spasm and rigidity over entire rectus muscle on right side with tenderness most marked in the flank and right lower quadrant. No tenderness over kidneys, neither kidney palpable.

Laboratory examination of urine shows alkaline, specific gravity, 1013, albumin positive, microscopic negative. Hæmoglobin, 88 per cent. S., red blood cells, 3,864,000; white blood cells, 8,150; differential count normal.

Genito-urinary examination shows, vulva wet, with urine oozing from vagina. Urethral orifice normal. Patient catheterized and bladder emptied. Urine continued to ooze from vagina.

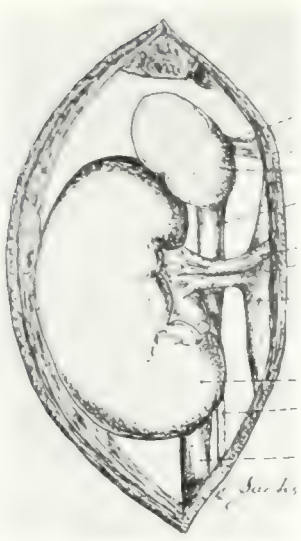

Fig. 6. Schematic drawing showing supernumerary kidney.

Vaginal and cystoscopic examination. As the outlet was virginal, it was very difficult to introduce a speculum, without causing a great deal of discomfort, so we injected into the perineum about 15 cubic centimeters of 1 per cent solution of novocaine. This had its desired effect in anæsthetizing the parts, so that we could introduce a speculum to search for the leakage in the vagina. A small opening about 7 millimeters was found in the anterior wall of the vagina, to the right of the cervix, which dripped urine. The bladder was now filled with a methylene-blue solution, and the opening in the vagina watched for the escape of any blue solution, but none came through. A No. 7 renal roentgenographic catheter was passed into the opening, and after a little patience it was made to pass on upward about 6 inches. The cystoscopic examination was made by the water method. The ureteral orifices were normal, one on either side, and perfect in appearance. The catheters were passed in each ureter as far as the pelvis of the kidney. Urine was collected from all three catheters. The one in the vagina was labeled F. and the other catheters were labeled as to their respective sides right and left. The rate of dripping was three drops each from right and left to one in F. The urine was collected from all three catheters and examined chemically and microscopically. It was negative from all three catheters, cultures were made from all three catheters, which were sterile. We next made an intravenous phenolsulphonephthalein test, and collected for 20 minutes: right side 30 per cent, left 42 per cent, F. 2½ per cent. We next made a roentgenogram of the roentgenographic catheters in their respective places. This was done to locate our F. catheter. From the roentgenogram, the F. catheter was located on the right side. The right kidney and F. catheter were filled with opaque solution, and a pyelogram taken (Fig. 1). The pyelogram shows the right kidney beautifully outlined with its calyces, and a large hydro-ureter. Two days later, we again cystoscoped the patient, for the purpose of determining whether we had a kidney with a double pelvis, and if the ureters anastomosed in some part of their course with one ending in a blind pouch. The pyelogram, Figure 2, shows clearly that it did not anastomose with the other ureter in any part of its course, but at the extreme end of the ureter, there can be seen three small rudimentary calyces.

We summed up from our cystoscopic examinations in the following manner. The opening in the vagina was coming from a separate ureter, which did not anastomose with the right ureter. There was a normal pelvis in the right kidney. The large hydro-ureter ended with rudimentary calyces, with a 2½ per cent of phenolphthalein output.

We made a pre-operative diagnosis of supernumerary kidney with a hydro-ureter opening into the vagina. We had every reason to believe that this large dilated ureter was the result of the plastic operation, which was done some years ago, and narrowed the outlet of the ureter. The small diameter of the outlet dammed the urine back, and dilated the ureter. The kidney being small could not dilate. This gave the large hydro-ureter, as shown in the pyelogram, Figure 3, and in the photograph of the gross specimen.

Dr. Leopold and I consulted as to removing this supernumerary kidney, and we both agreed that under the circumstance, it was the best thing to do, even if we had to remove the right kidney. To attempt a plastic operation by putting the fistulous opening into the bladder, would shorten the vagina, and if it did not heal, the patient would be in worse condition. To shorten the vagina in a young woman by a plastic operation was out of the question, because, if pregnancy should occur in the future, there would be little hope for a normal delivery, or the bladder might be seriously injured during the delivery.

Patient agreed to have done whatever we thought was necessary in order to cure her, as she had been in constant discomfort since she could remember.

Operation. Through a right anterolateral incision the posterior peritoneum was opened, exposing the perirenal fat, which was separated by blunt dissection. A normal right kidney was found lying in the renal pocket. At the upper pole of the kidney was a small mass of kidney tissue 4 centimeters by 4 centimeters. Each kidney was enclosed in a distinct separate capsule, the capsule being adherent at one point. Supplying the accessory kidney was a small artery and vein. The artery branched from the abdominal aorta at a point just above the artery supplying the larger kidney.

The artery and vein to the supernumerary kidney being very short, it was necessary to clamp and cut them before the kidney could be raised out of its bed. The accessory kidney was now separated from its line of fibrous attachment to the capsule of the other kidney. A slight drawing upward of the detached accessory kidney showed the larger hydro-ureter passing posterior the blood vessels and pelvis of the other kidney. The ureter was dissected downward for about 3 inches. Between clamps it was removed by cautery. The stump was ligated with black silk and inverted. A cigarette drain was introduced, and the wound closed in usual manner.

Time of operation, one hour. Patient left operating room in good condition.

Drain was removed on fourth day, sutures on eighth day, and wound had healed perfectly

Postoperative notes. Patient made an uneventful recovery. There has been no leakage from the opening in the vagina.

The specimen is a small kidney, with a large dilated ureter. There are two lobes in the kidney substance. The kidney measures 4 centimeters by 4 centimeters. The kidney is completely enclosed in a capsule, which strips easily. The posterior surface is slightly roughened, and there is a thin fibrous band running into the kidney substance. In this small band of fibrous tissue, there is seen a small artery and vein. The vein does not branch. On section the kidney shows pyramids, but they are dwarfed. The pelvis of the kidney is dilated, and does not show a definite outline from that of the ureter. The diameter of the pelvis is 0.5 centimeter. The ureter measured 12 centimeters long. It is of a redish white color. The walls are thickened. The diameter is 0.5 centimeter.

1. [illegible]
2. [illegible] xiii, 303.
3. [illegible] 44
4. [illegible]
5. [illegible]
6. [illegible]
7. [illegible] lxxxiv, 223.
8. CALABRESE. Ann. d. mal. d. org. gen.-urin., Paris, 1908, ii, 1841.
9. [illegible]
10. [illegible]

DOUBLE SCROTUM WITH GANGRENE FOLLOWING STRANGULATION

By KENNETH MACKENZIE, M.D., M.Ch. Edin., F.R.C.S. Eng., Auckland, New Zealand

A SINGLE man aged 54 was admitted under my care at the Auckland District Hospital and gave this curious history. He had, he said, always been different from other men, his scrotum being in two parts. Each part was very pendulous and this annoyed him. Five days previously a brilliant idea had struck him, and he had taken the two sacs with their respective testicles and had tied them in a single knot across the dorsum of the penis. Soon afterward they began to swell and he was unable to untie them. Daily they increased in size and darkened in color.

Examination revealed two tumors almost black in color and with a thin, evil-smelling discharge oozing from them. The upper tumor, the left scrotum, was of the size of the closed fist and lay above the pubis. The right scrotum was as large again as the left and lay in the perineum. The pedicles of the two scrota were tied in a firm knot across the pubis. Beneath lay the penis greatly enlarged by œdema. There was no possibility

Fig. 1. Surface view of specimen [illegible]

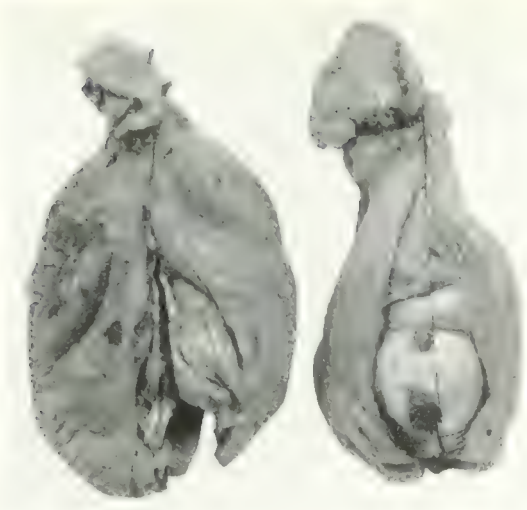

Fig. 2. View from the front, scrota opened and testicles showing.

of untying the knot, so the right scrotum was laid open. It and the contained testicle were completely gangrenous. An incision was made around the right external abdominal ring, the spermatic cord was severed, and the right scrotum removed. The left scrotum was then explored, and it and the testicle were likewise found gangrenous and were removed. It was interesting then to see that both scrota had been removed by circular incision at the external abdominal rings. The raw area left on each side was about the size of a penny. There were no scrotal attachments whatever to the perineum. The knot, which had rested on the dorsum of the penis, had formed a deep pressure sore there. The man made an uneventful recovery.

I cannot find in the literature to which I have access any account of so completely separated portions of the scrotum, or of any accident similar to the one described.

REPORT BY PROFESSOR A. M. DRENNAN

Reference No. D.B. 1–1425. The specimens are two in number and very similar in appearance. Each specimen has a narrow pedicle consisting of the usual structures of a spermatic cord with fatty tissue around, the whole covered by skin in which are hairs. This pedicle is continuous with an oval mass 4 inches long, covered by hairy skin which is purplish brown in color and the superficial epidermis is detached in parts. On cutting into this oval mass it is seen to consist of fatty tissue infiltrated with blood and with greatly engorged blood vessels; lying at the lower pole is a testicle, one and three-quarter inches long, with epidermis and tunica vaginalis. The testicles, epididymis, and surrounding tissue are all dark red from hæmorrhage into the interstices of the tissue.

Fig. 3. View of cut surface of both specimens. The testicle is seen at the lower pole, but it and adjacent tissue are not clearly defined owing to the hæmorrhage in both.

With the exception of the hæmorrhage the testicle and cord appear normal except that each testicle has a complete scrotum to itself, that is, the scrotum has been completely divided into two separate portions in this case. The hæmorrhage and congestion are the result of strangulation from the manipulation carried out by the patient.

Reference to the photographs will make the above clear.

The condition, as far as I know, is extremely rare and I have no references to it in the literature at my disposal.

RENAL AND HEPATIC INSUFFICIENCY IN OBSTRUCTIVE JAUNDICE

By WALTMAN WALTERS, M.D., and DUNCAN PARHAM, M.D., Ro

OPERATIONS on patients with obstructive jaundice offer three avenues of danger, aside from the so-called accidents of surgery: (1) hæmorrhage, (2) uræmia, and (3) hepatic insufficiency.

Hæmorrhage. The extreme danger from hæmorrhage in the presence of jaundice is well known. In a previous review of the necropsy findings in twenty-nine cases of obstructive jaundice, it was shown that serious postoperative hæmorrhage occurred in more than 50 per cent. A method of pre-operative preparation of patients was described. That such preoperative preparation has met with success is evident from the fact that in the last series of thirty-four patients with obstructive jaundice who received this preparation, there was but one case of serious postoperative bleeding.

Uræmia. A large percentage of patients with obstructive jaundice have a certain amount of albumin and some casts in the urine. If albumin is slight and casts few, the blood urea only moderately elevated, and the urine output satisfactory, operation is warranted, provided a normal blood coagulation time exists.

Case 1 is illustrative of the fact that renal insufficiency occurs as a terminal event in cases of obstructive jaundice in which operation has not been performed.

Case 1. (A313919.) Mr. J. V., age 68, entered the Clinic October 5, 10[illegible], with a history typical of gallstone colic followed by jaundice which became deeper progressively and was marked [illegible] the time of examination. The stools were clay colored. A twelve-hour specimen of urine contained a large amount of albumin, hyaline and granular casts, and leucocytes. The coagulation time of the blood was 12 minutes.

The patient was referred to the hospital October 8 for pre-operative preparation, but because of the nausea and vomiting it was thought best first to place him under observation for 24 hours. During the next 42 hours the jaundice deepened; the patient passed only 180 cubic centimeters of urine, in spite of a subcutaneous intake of 1800 cubic centimeters of normal salt solution. Occasionally blood was noted in the vomitus. The patient became restless and noisy, then drowsy and stuporous. October 10, the day before his death, the blood urea was 294 milligrams for each 100 cubic centimeters, and creatinin 5.8 milligrams. Necropsy revealed chronic diffuse nephritis and hæmorrhage into the gastro-intestinal [illegible]. [illegible] the cause of the complete suppression [illegible]. Operation was deferred on account of the high coagulation [illegible] and renal [illegible].

In a large percentage of the cases of obstructive jaundice after ether anæsthesia was used the blood urea became double the preoperative quantity the second or third day after operation. When local anæsthesia, by infiltration of the abdominal wall, was combined with a slight amount of ether (usually 30 to 75 cubic centimeters), the rise in the blood urea was noted in a smaller proportion of the cases. As a rule such a rise 48 to 72 hours after operation gradually disappears, and without other trouble the patient has a steady normal convalescence. Unfortunately some patients do not get on so well. If, after operation, there is an increase in the cholangeitis or if biliary drainage becomes insufficient, there may be a greater retention of bile with an increase in the jaundice and in the blood coagulation time and a concomitant increase in nephritis with rising blood urea. These patients sometimes show an alarming picture of uræmia and may not recover.

The findings in a typical case of obstructive jaundice in which the patient died of renal insufficiency secondary to operation are as follows:

Case [illegible]. (A[illegible].) Mr. L. [illegible], entered the Clinic October [illegible]. Six weeks previously he had developed jaundice and generalized pruritis, clay stools and marked constipation. The urine contained [illegible] casts 1. The coagulation time of the blood was 10 minutes. Cholecystogastrostomy for carcinoma of the head of the pancreas was performed. The third day after operation urinary retention necessitated catheterization; marked hæmaturia followed. The fourth day after operation, the blood urea was [illegible] milligrams; it rose to 360 milligrams and the creat-

[illegible] twice; he died on the ninth day apparently [illegible]. Necropsy revealed marked [illegible] in the urinary bladder in the gall bladder, and in the gastro-intestinal tract

Neither this patient nor the patient in Case 1 was given calcium chloride intravenously.

The only treatment indicated in these cases is for any impending uræmia. Drains should be carefully inspected to see that they are not [illegible].

Hepatic insufficiency. Too little consideration has been given to the incompetent liver as an obstacle to the recovery of the patient with obstructive jaundice. Because of the remarkable compensatory and regenerative abilities of the liver, it has been difficult to obtain exact data with regard to liver failure. It may be safer to regard these patients as suffering from lack of sufficient hepatic function rather than from hepatic insufficiency. The trouble may not be so much an intrinsic lack of vigor of the liver cell as the liver's inability to function properly because of obstruction in the avenue of excretion. The term cholæmia is sometimes used to signify the symptoms accompanying the retention in the blood of toxic products which the liver has failed to eliminate. Cholæmia means bile in the blood, but as a clinical expression it is often used loosely to mean almost any untoward syndrome occurring in jaundiced patients. Terms such as cholæmic nephritis and cholæmic hepatitis, might be used. It would seem better simply to use the word as meaning the presence of bile in the blood. Be this as it may, it is certain that patients with common duct obstructions present a so-called biliary cirrhosis of various degrees, more correctly central atrophy and cholangeitis. When this is so marked that the liver is a yellow, bile-stained organ, shrunken to two-thirds its normal size, the prognosis as to the outcome is very serious. An alarming percentage of patients thus affected die from lack of hepatic function.

At necropsy in such cases the liver is small and yellow, sometimes weighing less than 1000 grams, although in some instances it may be larger than normal. There are many bile thrombi in the canaliculi of the central portion of the lobules. The hepatic cells of the central [illegible] are atrophied, although there is a great deal of fairly good liver tissue in the periphery of the lobules. However, the latter often shows slight hydropic change or a moderate amount of fine fat granules as revealed by Sudan III stain. There is scarcely enough definite abnormality present to make the liver inadequacy recognizable from a morphological standpoint. On the other hand, the better known syndrome of renal insufficiency cannot always be diagnosed at necropsy.

Clinical picture of hepatic insufficiency. Usually the first 2 to 8 days after operation the course is uneventful: biliary drainage and urinary output are normal, fluids are taken well, the pulse and temperature are normal. One of the first signs of the onset of trouble is paling and thinning of the bile with marked increase in the flow. This profuse cholerrhagia does not continue long, but the bile remains thin. The patient begins to grow weaker, the pulse loses volume, and the temperature becomes subnormal. Restlessness and irritability develop with great fatigue and muscular weakness. Soon regurgitant vomiting follows intake of liquids by mouth, and little taken by rectum is retained. Jaundice does not deepen markedly, but there is an increasing pallor beneath the icteric hue, the face becomes drawn, and the eyes anxious. The patient grows progressively weaker and finally dies. The urinary output remains proportional to the fluid intake throughout, and the urine reveals little or no evidence of marked nephritis. The blood urea remains persistently low.

The histories of four cases are presented herewith in which there was a definite clinical picture of the lack of hepatic function.

Case 3. (A383124.) Mrs. G. B. B., age 61, presented herself at the Mayo Clinic for examination February 2, 1922. She had complained of attacks of epigastric pain for 45 years, more severe for the last 10 years. Four years before, the jaundice first appeared during such an attack. July, 1918, cholecystostomy was performed elsewhere; one large stone was removed. Attacks of nausea, vomiting, and jaundice persisted, and in December, 1920, cholecystectomy was performed elsewhere. Following this, fluctuating jaundice persisted, and clay stools, constipation, and general pruritis appeared.

Examination revealed jaundice. The systolic blood pressure was 144, the diastolic 84. The pulse

was 72, and temperature 98.5°. The patient weighed 101 pounds; her normal weight was 140 pounds. The hæmoglobin was 68 per cent, the erythrocytes numbered 4,090,000, the leucocytes 8,900. The specific gravity of the urine was 1.021, albumin 0, sugar 0, casts 0, erythrocytes 0, and pus 1 (scale of 1 to 4). Bile, urobilin and urobilinogen were present.

February 5, the patient was sent to the hospital and pre-operative preparation begun. The coagulation time was found [illegible] minutes. Lee and White method), nevertheless 10 cubic centimeters of 10 per cent calcium chloride was given intravenously. The blood urea was 20 milligrams for each 100 cubic centimeters.

February 7, choledochostomy was performed for choledocholithiasis. The common duct was 2.5 centimeters in diameter. [illegible] Local anæsthesia with whiffs of ether was used. Following operation the biliary drainage and urinary output were satisfactory, and the jaundice cleared slightly. On the fifth day bile ceased draining through the tube and there was only slight drainage around the tube. Aspiration and manipulation of the tube loosened the obstruction with restoration of drainage. On the seventh day the bile became thin and pale, but excessive in amount [illegible] cubic centimeters in 24 hours. The urinary output was [illegible] cubic centimeters. Biliary drainage continued thin but gradually became reduced in amount. The blood urea on the eighth day was 34 milligrams for each 100 cubic centimeters. On the ninth day the urinary output became less and remained so. The urine contained a moderate amount of albumin and many hyaline casts. On the tenth day the leucocytes were 34,000. The patient grew restless, then drowsy, and became progressively weaker until she died on the fifteenth day. There was a slight sanguineous discharge from the wound the last 7 days.

Necropsy revealed a sinus passing down to the region of the common duct from which thick, purulent material exuded. There was no generalized peritonitis, very little gross hæmorrhage in the region of the wound, and none elsewhere. The heart and lungs were practically normal. The liver was small, weighing [illegible] grams, and its cut surface presented a brownish green mottling. The lobule markings were not distinct. The common and hepatic ducts were dilated. Microscopic examination revealed cells around the central veins shrunken in size, their shape irregular. In some lobules this condition extended out to the periphery. In the sinuses around the central vein was a moderate amount of brownish black pigment. The kidneys were atrophic, weighing together, 185 grams. Microscopic examination showed moderate, cloudy swelling, areas of rather marked interstitial fibrosis, and many hyalinized glomeruli and atrophied tubules. There was considerable bile pigment. Death was attributed to nephritis complicated by lack of hepatic function.

Case 4. (A381682.) Mrs. C. Z. W., age 40, presented herself for examination January 13, 1922, giving a history of recurring attacks of right upper abdominal pain without jaundice. [illegible] had been performed elsewhere September [illegible]. Shortly afterward jaundice developed, at first fluctuating, then persistently intense. The patient had lost considerably in weight.

The systolic blood pressure was 110, the diastolic [illegible]. The [illegible] per cent, the erythrocytes numbered 4,490,000. The coagulation time was 8 minutes. The urine contained a moderate amount of albumin, and casts.

The pre-operative preparation was begun January 15; 31 cubic centimeters of calcium chloride was given intravenously in four doses. The coagulation time of the blood was reduced to 3 minutes. [illegible] was performed because of the absence of the common duct. Marked biliary cirrhosis and an atrophic liver were noted. The patient [illegible] operation. On the third day, the jaundice seemed to deepen, and weakness progressed. On the [illegible] day, the pulse had risen to 110; on the morning of the fourth day it became increasingly weak and rapid and the patient [illegible]. Vomiting of "coffee" ground material occurred often. There was moderate oozing from the wound the third night. The temperature [illegible] second and third days, falling shortly before death. Aside from marked cardiovascular asthenia, the heart and lungs were negative. The urinary output was [illegible] cubic centimeters the first day, 510 cubic centimeters the second day, scanty the third day, and anuria developed the fourth day after operation. The urine contained a moderate amount of albumin but no casts. The blood urea before operation was 26 milligrams for each 100 cubic centimeters and the third day after operation, 68 milligrams. Death, which occurred on the fourth day, seemed to be due to general asthenia with insufficient hepatic function, complicated by moderate internal hæmorrhage.

Only an incomplete necropsy could be [illegible]. There was less than 480 cubic centimeters of blood in the abdomen. Microscopic examination of the liver revealed bile thrombi, atrophy of the liver cells around the central veins, [illegible] the cells of the peripheral zone. Moderate fibrosis and lymphocytic infiltration surrounded the portal areas. The kidneys contained occasional sclerosed glomeruli and atrophic tubules with moderate swelling and [illegible]. An excessive amount of bile pigment and many bile casts were present.

This is the only patient receiving pre-operative preparation with calcium who had serious postoperative bleeding, and in this instance the bleeding seemed only contributory. On the morning death occurred, the coagulation time was 21 minutes and the calcium time 12 minutes.

Case 5. (A381[illegible].) Mr. E. G. [illegible] presented himself for examination November 18, 1921. He had

TABLE I.—CASE 5.

									5,000			
					0		1					Operation
	1050	900										
	960	800										
		600			Trace			+				
												Death (9:15 a.m.)

been perfectly well until February, 1919, when he had an attack of influenza, followed by increased thirst and polyuria. The urine contained sugar. No treatment was given. The patient began to lose weight and strength. May, 1921, pain and tenderness developed in the upper abdomen, and, in June, a mass in the epigastrium was discovered. The mass disappeared and symptoms were relieved, except for slight pain and jaundice, which persisted. Six weeks before, jaundice had become more intense.

Examination revealed jaundice 2, pallor 1, and emaciation 1 to 2. The systolic blood pressure was 130, the diastolic 80; the pulse was 76. The patient's normal weight was 250 pounds; the present weight was 147 pounds. The specific gravity of the urine was 1.022; albumin 1, a trace of sugar, and pus were found. The hæmoglobin was 78 per cent. The erythrocytes numbered 3,980,000 and the leucocytes 5,000. The stools were clay colored and stercobilin was absent. The blood urea was 17 milligrams for each 100 cubic centimeters. The blood sugar was 0.21 milligrams. The coagulation time was 8 minutes

The patient was sent to the hospital and received forced fluids and the diet for diabetic patients. The urinary output varied from 500 to 1600 cubic centimeters a day. The sugar disappeared from the urine. A transfusion was given of 500 cubic centimeters of citrated blood November 29, and the next day the coagulation time was 6 minutes.

December 1, 1921, cholecystostomy was performed. Pancreatitis 4, biliary cirrhosis 3, and a hard nodule of the head of the pancreas were noted. White bile exuded from the dilated common duct. A profuse drainage of thin, pale bile followed the operation. The patient grew progressively worse after the fourth day. Pulse and heart sounds became feeble, and muscular weakness increased. The patient became drowsy, indifferent, and irritably restless. The urinary output was satisfactory throughout and remained sugar free during his entire postoperative course. At no time was acetone present in the urine. On the seventh day, the patient complained of pain under the right ribs radiating to the right shoulder. The leucocytes numbered 25,000 The vomitus was coffee ground in type, and death occurred on the ninth day (Table I).

At necropsy the liver weighed 2550 grams, but showed marked central atrophy and hydropic change in the cells of the peripheral zones. The kidneys, together, weighed 413 grams and revealed only moderate signs of nephritis. There was carcinoma of the head of the pancreas, miliary gastric ulcers, right adhesive pleuritis, and old endocarditis; coronary sclerosis and purulent seminal vesiculitis were the only other important pathologic changes.

The liver appeared to have been responsible for the death of this patient. Many surgeons have called attention to the seriousness of finding white bile at operation (1, 2, 4). The discharge after operation contained some bile, but was chiefly seromucous.

In many instances in which the patients do not progress satisfactorily, there is undoubtedly a combination of insufficient renal and hepatic function. Either may dominate the picture and their relative importance may change. Case 6 is of interest in this regard.

Case 6. (A379535.) Mr. T. S., age 64, presented himself for examination December 13, 1921. He had enjoyed excellent health until March, 1921, when he was taken ill with an attack of dizziness, weakness, and general malaise. In April, jaundice with clay-colored stools developed. His weight dropped from 235 pounds to 165 pounds in 3 months. The only pain was a dull ache in the posterior thoracic region

and in both shoulders. He improved gradually from July to November, the jaundice remaining faint. November 24, jaundice again became deep, accompanied by malaise, and [illegible] He passed from five to six frothy white stools a day.

Examination revealed intense jaundice, 3 to 4. The weight was 157 pounds, emaciation 2. [illegible] tolic blood pressure [illegible] The pulse was 76. The urine contained a moderate amount of albumin and [illegible] casts. The hæmoglobin was 66 per cent; the erythrocytes numbered 10,900.

The patient was sent to the hospital for pre-operative preparation. The coagulation time of the blood was reduced from 7 to 3 minutes by intravenous injection of 25 cubic centimeters of 10 per cent calcium chloride solution in three doses. The blood urea before operation was 24 milligrams. December 20, 1921, choledochostomy for choledocholithiasis was performed. Marked biliary cirrhosis and subacute pancreatitis were noted. The gall-bladder was contracted and did not contain stones. Drainage was instituted.

The postoperative course was satisfactory until the fifth day when the patient experienced a sharp pain in the abdomen radiating to the right shoulder. This was followed by slight deepening of the jaundice and slight decrease in the flow of bile. The blood urea was 60 milligrams. For the next 6 days there were increasing signs of uræmia. On the eleventh day, the blood urea rose to 208 milligrams. The urine was loaded with hyaline and granular casts. The leucocyte count was 20,000. At the same time the blood showed a great quantity of bile macroscopically, and the coagulation time was 16 minutes. During the next few days the nephritis improved markedly. There was an excessive flow of very thin bile the twelfth and thirteenth days, and although the quantity was large the total amount of bile pigment seemed to be decreased. On the sixteenth day the blood urea was 128 milligrams and there were only a few casts in the urine. The blood contained less bile and the coagulation time was 8 minutes. Although the function of the kidneys seemed to be improving, the patient became worse about the twelfth day. Weakness increased. The pulse and respiration grew more feeble. The patient became restless and indifferent. The bile drainage remained very thin though less in amount. Death occurred on the nineteenth day after operation. The urinary output had remained satisfactory throughout.

Necropsy revealed the liver to be firm and shrunken, and weighing 1500 grams. There was a purulent discharge from the bile ducts. Microscopically, there were many bile thrombi in the capillaries of the central region; the hepatic cells were shrunken and distorted. There was moderate fibrosis of the portal areas with lymphocytic infiltration and a few polymorphonuclears. The combined weight of the kidneys was 325 grams. There were definite macroscopic and microscopic signs of nephritis.

Cumston, in a review of the conclusions of many French observers, Hélouin, Ramond, Géraudel, Sacquepée, Merklen, Lioust, and others, points out the fact that icterus may accompany acute nephritis with little or no manifestations of pathological condition in the liver. Azotæmia is thought to be due to the renal insufficiency and to hyperfunction of the liver. In Case 6 the general picture was of clearing nephritis. The lowering of the blood urea was probably due to better elimination by the kidneys, and to diminished formation of urea, owing to lowered hepatic function.

Thus, the patient with obstructive jaundice dies from hæmorrhage, or renal or hepatic insufficiency. Hepatic insufficiency we believe differs from renal insufficiency; associated with the former there is abundant drainage of light colored bile, containing small amounts of the bile pigments. Patients become restless, then drowsy and stuporous, and finally succumb. During the entire course of the hepatic insufficiency little change occurs in content or volume of the urine, and the blood urea remains persistently low. Renal insufficiency is associated with the cessation of drainage of bile. But with the cessation of drainage, evidence is shown in the urine from day to day of a progressing nephritis, and the anæmia may increase in the last stages. During this period of renal insufficiency secondary to the damming back of the bile in the circulation, the jaundice deepens, the coagulation time of the blood lengthens, and the blood urea progressively ascends to the level of uræmia.

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SYPHILIS OF THE UTERUS

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IN the various textbooks on medicine and surgery, as well as in the more specialized books on syphilis, much attention has been given to the cutaneous, cerebral, and osseus changes which occur as a result of syphilis, but until comparatively recently, little has been said of the visceral changes, or little of the thoracic and abdominal and pelvic viscera as affected by this common disease.

Within the past few years more attention has been directed to the thoracic, abdominal, and pelvic viscera and it is now rather well known that a large percentage of so-called tuberculous lungs are syphilitic; that many liver and metabolic disorders are syphilitic, that frequently so-called gastric carcinoma or duodenal ulcer is syphilitic, and that many cases of gastric or intestinal mal-digestion are due to disturbed arterial function—and that syphilis is not infrequently a factor in producing this. It has been less commonly recognized that more than occasionally fibrosis of the kidney, i.e., interstitial nephritis is of syphilitic origin; and only very rarely that there are a considerable number of cases in which the uterus is the organ which shows the main pathology in spirochætal infections. When, about 1907, I began to look in the textbooks for some reference to this condition, I found in one volume a brief note to the effect that syphilis may affect the uterus.

From 1905 to 1914 I had charge of the gynecological clinic at Shirras Dispensary in Charleston, S. C., and during that time saw approximately 2000 cases (2165). As a number of these were "repeat" cases extending over 2 or 3 years, I may reduce this number by, say, 500, and consider that I have attended about 1500 women during that time. A trifle over 1 per cent of these were white, the remainder negroes.

Patients with all sorts of diseases and conditions appeared at the clinic, but only a small proportion were true gynecological cases. However, by 1907 I began to realize that in a certain number of cases there was a pretty constant complex of uterine or pelvic symptoms and that, if observed closely, this complex usually accompanied evidences of syphilis elsewhere. Wassermann tests were unavailable at a charity clinic at that time and for diagnosis I had to rely upon observation, history (usually faulty and sometimes purposely false), physical examinations, and finally the therapeutic test. In consequence of this my figures are approximate and are open to criticism. Moreover, I am quoting largely from memory, as my connection with this clinic was severed in 1914. I was able recently to obtain access to the record book of visits, but the diagnoses were not complete and I have to give approximate figures.

To the best of my recollection I had accumulated 87 cases which I believed were clearly cases of syphilis of the uterus. I had hoped to get 100 cases before writing an account of my observations, but I was not able to do this before leaving the clinic. Nothing further was done with my observations until about a year ago when I asked Dr. John Clarke of Philadelphia, if he would give me the result of his observation in this connection. He promised to have his clinic take the matter under study and I understand he has accumulated considerable data already.

When I speak of syphilis of the uterus I do not mean to classify a disease limited to one organ nor to describe cases where the whole pathology is limited to the uterus—such cases, in my opinion, do not exist. But I aim to direct attention to syphilitic affections which produce marked change in the uterus and its adnexa, and which give a group of symptoms usually ascribed to other causes; in other words, I mean to discuss uterine changes due to syphilis.

As to the etiology of syphilis, of course all of us know it so well that no discussion need be given. As to the predisposing factors which might cause a uterine predilection for syphilitic changes, all of us should know, but many of us are forgetful of the fact that any vascular organ, especially one where the circula-

tion is variable, is apt to be a sufferer from these changes, consequently the brain, the spinal cord, the lungs, the liver, the kidneys, the bones and the uterus are all apt to suffer. When we consider the pathology of the di[illegible] we can readily understand the reason.

The essential pathology of all syphilitic changes is an endarteritis and a peri-arteritis probably toxic in nature [illegible] toxin seeming to be a stimulant to cell prolification, especially to round-cell infiltration and organization. It seems to be somewhat of a paralyzant of vascular tonus producing in its early manifestations local and general hyperæmias and later thickening of va[illegible] walls, especially of the arteries. From this essential pathology the entire question of the pathology and the symptomatology of syphilis might be worked out without error. As to the special uterine pathology we may take up its progress step by step.

1. *The initial sore.* This [illegible] the cervix uteri or may be anywhere else—is usually elsewhere. But should it be on the cervix we find the cervix large, soft, congested, usually one lip more enlarged than the other. Generally there is an ulcer which is surrounded by a bluish areola or by a deeply inflamed border. The surface of this ulcer is nearly always covered with a dirty looking membrane, though it may be fairly clean looking. The ulcer feels as if it were on a thickened base rather than on a punched-out area. There is usually some leucorrhœa—most often of a sero-sanguineous character. When the ulcer heals there is generally evidence of scar or cicatrix at its site. But description of cervical chancres can be found in almost any textbook on gynecology.

Regardless of where the initial sore is, the changes occurring later may be the same. Following on the heels of the chancre, or at a variable length of time after it, commence the toxic changes. Just as we find the pharyngitis, gastritis, enteritis, and skin rashes, so we find the uterine body and mucosa evidencing changes. In this stage the uterus is commonly heavier than normal and the endometrium congested—evidenced by leucorrhœa, menorrhagia, and pelvic discomfort. So far no real changes have occurred only a passive congestion from a toxic vascular dilatation.

Following this stage the tissues seem to become more or less accustomed to the t[illegible] and their reflexes [illegible] However, the spirochætæ continue to in[illegible] and after a while the particular [illegible] most susceptible to the toxins b[illegible] Should it be the uterus we find that the organ commences to increase in size, the cervix to become softer and more juicy, the uterus to feel heavy and softer than normal, and [illegible] ually to reach [illegible] the normal. During this stage the organ is passively congested. There is decided cell proliferation extravascularly, and some intravascularly. Occasionally there is peri-uterine inflammation with cobwebby adhesions to other structures; but in a greater proportion [illegible] es there is not, and the uterus is movable, but with difficulty, owing to its incre[illegible] in size and weight. Retroflexion, pressure on the rectum, and interference with the circul[illegible] of the ovaries may result from the same cause. This stage I have called the hyperplastic stage, or wet uterus.

With organization of the new-formed cells a steady change to the next stage follows. As organization occurs and as the endarteritis accompanies the peri-arterial infiltration, we find the new-formed fibrous tissue shrinking and the uterus becoming more [illegible] less juicy and smaller. Steadily the contraction occurs until finally the uterus is from two-thirds to even one-half the normal size, is freely movable, hard, dense, fibrous in feel, cervix, small and firm, and mucosa thin, pale and ill-nourished. I would expect to find small areas of vessels caught by the constriction and full of blood in the removed uterus, i.e., small punctate hæmorrhages. These I have not noticed. The uterus in such cases is usually rather insensitive, easily outlined on palpation, and freely [illegible] able. Should the hyperplastic stage have [illegible] intense, however, adhesion might have fixed it more or less—commonly less. This stage I have classified as the hypoplastic sta[illegible] dry uterus. The proportion of cases seen in the hyperplastic to those seen in the hypoplastic stage I have observed to be about one

to four or five. This is to be expected. As earlier recognition and treatment of such [illegible] advance, the proportion will naturally change.

Considering the pathology, the symptomatology is rather obvious. The general symptoms are commonly known. The uterine symptoms are often ascribed to other causes.

In the initial stage with cervical chancre, of course there is leucorrhœa of a sero-sanguineous, or of a sanguino-purulent character, if there is a mixed infection. The discharge often has a disagreeable acrid odor which does not persist very long on the guards after exposure to air. There may be some pain and feeling of heat in the pelvis and often backache. Examination with speculum or gloved finger usually discloses the ulcer described above. When mixed infection with pyogenic organisms occurs, broad ligament or tubal infection may follow with their chain of symptoms. The leucorrhœa of the initial stage may persist into the stage of secondaries or may subside during the quiescent stages. Accompanying the stage of the secondary or toxic symptoms, the uterine symptoms are often lost sight of in the maze of other troubles. With the eruption, the pharyngitis, the diarrhœa and the fever which often mark the so-called secondaries, or the toxic stage, the pain in the back, heaviness in pelvis, menorrhagia, metorrhagia, leucorrhœa and other symptoms of pelvic congestion are overlooked, but they are often there. Owing to the congestion of the uterus, symptoms of pressure on bladder and rectum are complained of, with tenderness of the uterus on palpation, and of the ovaries on pressure. The menstrual period is prolonged and the flow increased in amount, metorrhagia is common and leucorrhœa the rule—being usually serosanguineous, infrequently purulent. This usually subsides with the passage of the toxic stage, but not completely as a rule, a thin discharge being left. The onset of this stage is often rather rapid or even sudden and the ending by lysis.

In the quiescent stage there is usually little to note. The uterus is apt to be still somewhat engorged and to present the expected symptoms of this engorgement.

The onset of the next stage that of hyperplasia, is gradual. The patient cannot usually fix the time of the first symptoms. There is a gradual increase in feeling of weight and pressure in the pelvis. The pressure in the rectum gradually increases and often produces constipation. The uterus, through its increase in weight is usually retroflexed, thus giving the common symptoms of retroflexion and of interference with ovarian circulation, i.e. pain in back, nervousness, etc.; sometimes nausea resembling the morning sickness of pregnancy, occurs, and misleads the examiner, especially in view of the enlargement of the uterus. If there is great engorgement, pressure on the bladder may cause frequent desire to micturate. A serosanguineous leucorrhœa is common. Menorrhagia, both as to time and quantity, is the rule, sometimes metorrhagia. The uterus is movable by the examining finger, but with difficulty on account of both its weight and its sensitiveness; the fundus is soft, juicy and generally more pear-shaped than globular. It feels boggy rather than like a cyst full of fluid. The cervix is soft though usually not so much so as in pregnancy. In this stage the abdominal walls are, as a rule, not so thin as later on and consequently the uterus, though larger, is not so easy to outline as in the hypoplastic stage. The vaginal mucosa looks more moist than usual and may be congested. Mucous patches may be in evidence. The outer genitals usually look congested and feel warm. The bluish tint of a pregnancy may be simulated, though this is not the rule. Often there is some injection of other mucous surfaces, especially of the pharynx and conjunctiva and of course discrete glandular enlargement is the rule.

As this stage passes into the final or dry stage the change is almost imperceptible. There is a gradual reduction of the pelvic symptoms. The backache is diminished; the pressure symptoms on rectum, bladder and ovaries pass. The menorrhagia ceases and the flow becomes more and more scant and less painful until frequently it is only of one day's duration or less and of a thin bloody or blood-tinged leucorrhœa. The metorrhagia disappears. The leucorrhœa becomes

thin and glairy and occasional. The introitus looks paler than normal and thinner, the vaginal mucosa looks paler and more fibrous than normal. The cervix is smaller and harder than normal, sometimes scarred. The uterus is usually in the normal anteflexed position, is small, hard, fibrous, and generally freely movable. Sexual desire is usually diminished. As there is commonly a marked diminution of surface fat in cases advanced thus far, palpation of the uterus is usually easy. Also the diminution in sensitiveness of both uterus and vagina in this stage render vaginal examination easier.

I have noticed that in a considerable per centage of these cases the skin assumes a rather characteristic appearance—a lack of normal elasticity and smoothness as it were, and at the same time the conjunctivæ seem paler than normal, but lose their clear transparent look and seem somewhat frosted. This appearance is hard to describe but easy to recognize. The glandular system, of course, presents the usual evidence of syphilis. Other organs may add their quota of symptoms at any stage of the disease—these symptoms we will not enumerate for lack of time.

A symptom I have not yet brought out is that of habitual abortion. Pregnancy complicated by syphilis is especially prone to end prematurely as is well known—when we consider the pathology of the syphilitic uterus it is easy to understand why this should be so. As a uterus passes through the wet stage it is less and less apt to retain a fœtus, and in the dry stage it is almost impossible for a fecundated ovum to find lodgment or nourishment in the fibrous-walled and membrane thined organ. I [illegible] abortion a complication of syphilis, but I think it would be more correct to [illegible] a pregnancy as a complication and an abortion as the natural result. Other complications as adhesion, pyosalpynx, etc., may occur. On opening the abdomen of the syphilitic it is not rare to see colewebby adhesions not only around the uterus but between the intestine.

The so called tertiary syphilitic affections of the uterus may in some cases be mistaken for carcinomata, and treated as such. Some of the remarkable recoveries after operation on extensive, apparently malignant, growths may be accounted for by this.

The diagnosis of syphilis is not always easy. Even with the common use of the Wassermann test our results are not 100 per cent correct. Sometimes we get negative Wassermann reactions in cases undoubtedly luetic and sometimes we get positive support from the laboratory only after provocative doses of potassium iodide or of arsphenamin. In reaching a diagnosis in our gynecological cases it is well to bear in mind that syphilis is a factor to be reckoned with.

Though the majority of my cases were between the ages of 19 and 23 yet the ages ran from 14 to 39 or older, so age does not exclude syphilis, nor does youth. Given, however, a combination of uterine symptoms with other evidences of syphilis, it is wise to try antisyphilitic treatment before operative measures of any sort are instituted.

A STUDY OF THE MATERNAL DEATHS AMONG TEN THOUSAND PARTURIENT WOMEN AT THE CHICAGO LYING-IN HOSPITAL[1]

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A STUDY was made of the last 10,000 parturient women admitted to the Chicago Lying-in Hospital and Dispensary with a view of analyzing the maternal deaths. These patients were admitted from November 1, 1914, to October 1, 1921, and during this time there were 39 deaths. This gives, therefore, a gross mortality of 0.39 per cent. The hospital is an open one and over three hundred different doctors send patients to it.

The age of the 39 patients varied from 18 to 42 years. Twenty patients were primiparæ and 19 were multiparæ.

The duration of the patients' stay in the hospital was as follows:

	Cases
Less than one day	3
One day	5
Two days	5
Three to ten days	11
Eleven to twenty days	6
More than twenty days	3
	39

Among the 39 patients, 26 babies (one twin) were born alive while 15 babies (one twin) were stillborn. However, at the time the mothers died, only 22 children were alive.

Of the 39 patients, 8 had been delivered in their homes before having been sent to the hospital. Five of these were delivered by our out-patient service while a sixth precipitated before the interne reached her home. The remaining two patients were delivered by an outside physician and a midwife respectively. Of the remaining 31 patients, 7 were ward patients, the rest being under the care of private physicians. Furthermore, of the 31 women delivered in the hospital, 6 had been examined vaginally in their homes by physicians or midwives.

Accepting Osler's statement that the normal oral temperature is rarely above 99.2°, we find that among the patients whose temperatures were recorded on admission, but 45 per cent had normal temperatures.

The manner in which these fatal cases were delivered was as follows:

	Cases	
Spontaneous delivery		17
Spontaneous delivery after induction of labor with colpeurynter		2
Low forceps		2
Mid forceps		4
Version and extraction		1
Forceps attempted, then version and extraction		1
Cæsarean section		7
Classic	6	
Kroenig	1	
Abdominal hysterectomy		2
Vaginal hysterotomy		1
		41 two pairs of twins

Two of the patients who delivered spontaneously, gave birth before the doctor reached them. Of the women who were delivered by mid-forceps, one died as the forceps were being applied. The stillborn child was extracted after maternal exitus and no rupture of the uterus or vagina was found postmortem. Another of the mid-forceps operations was performed by a midwife at the patient's home and the result was a ruptured uterus and a third degree laceration.

For the 7 patients who had cæsarean sections performed, the cause of death was as follows:

	Cases
Peritonitis	3 (2 Classic, 1 Kroenig)
Shock (from abruptio placentæ)	1 (Classic)
Eclampsia	1 (Classic)
Toxæmia	2 (Classic)

The two cæsarean sections for the patients with "toxæmia" were performed under local anæsthesia (novocaine). Of the three patients who died of peritonitis, two had been examined vaginally before operation.

The cause of death for the 39 patients was as follows:

1	Puerperal sepsis	6 One autopsy
3	Peritonitis	6 Two autopsies
3	Shock	2 One autopsy
	a. Ruptured uterus	3
	b. Hæmorrhage	5

[1] Read before the Chicago Gynecological Society, January 1, 1922.

4. Eclampsia		
5. Embolism		4 (One autopsy)
6. Pneumonia		1
a. Interstitial		
b. Lobar	1	
c. Broncho	1	
7. Cardiac decompensation		
8. Toxæmia		One autopsy)
9. Coronary thrombosis		1 Autopsy
10. Status lymphaticus with pulmonary œdema	1	(Autopsy)
		39 (Eight autopsies)

PUERPERAL SEPSIS

Three of the six patients who died of puerperal sepsis were delivered before admission to the hospital. Two were delivered by the dispensary internes and these patients had easy spontaneous labors. One patient had had sexual intercourse 2 days before delivery. In neither of these 2 women had a vaginal examination been made. The third patient who gave birth before admission, delivered spontaneously a premature baby in transverse position. Cultures from the blood of the baby's heart showed gas bacilli. This patient's temperature during labor was 101.5°. Her history stated that she had had puerperal infection one and a half years previously.

Of the remaining three patients dying of puerperal sepsis, namely those delivered in the hospital, one had been examined vaginally before admission without gloves and the patient's temperature when she entered the hospital was 100.8°. The membranes had ruptured 46 hours previously and there was a foul odor to the liquor amnii. The placenta which was very adherent had to be removed manually. The second patient delivered in the hospital who died of child-bed fever, was admitted with that diagnosis, her temperature being 100.6°, her pulse 136, and her respirations 50 to the minute. Immediately after delivery her temperature was 104°. The latter two patients were delivered with low forceps. The third woman who gave birth in the hospital, delivered herself spontaneously of twins and the placenta. Eleven days postpartum she had a severe hæmorrhage which necessitated curettage and tamponade of the uterus. Placental tissue was removed at this time, and the patient died of sepsis on the fortieth day after delivery. At autopsy, the uterus appeared normal but abscesses in both lungs were found.

Of the six patients dying of sepsis the placenta was removed manually in two. Four babies (one twin) were born alive while three were stillborn. All the patients but one had a temperature above 100.5° on admission to the hospital.

PERITONITIS

Among the six deaths from peritonitis, three followed cæsarean section, one an abdominal hysterectomy for ruptured uterus, the fifth one resulted from a ruptured appendix, and the sixth was associated with perforations of the small intestine. For those who died after cæsarean section two different types of operation had been performed: namely, classic (2) and Kroenig (1). As was stated above, two of the three cæsareanized patients had vaginal examinations before operation.

The patient on whom the Kroenig operation was performed was a woman weighing 278 pounds, whose blood pressure was 202–120, who had œdema of the legs and abdominal wall and albumin in the urine. She was two weeks overdue (the child weighed 3963 grams) and had been in labor 83 hours before the operation was performed. During the operation the bladder was accidentally perforated. The patient died 4 days later.

The patient who died of peritonitis three days after the abdominal hysterectomy was a multipara, who was brought to the hospital after her uterus had ruptured at home [illegible] hours after the beginning of the second stage of labor. Her temperature on admission was 103°.

In one of the women on whom a classic cæsarean section was performed, the abdominal wound separated all the way, before death, which occurred on the eighth day postoperative. Autopsy revealed peritonitis due to the staphylococcus aureus. The second patient who had a classic cæsarean section, like the former, died of peritonitis on the eighth day after operation, although she had also presumably been a "clean" case. Autopsy revealed pus in the uterine cavity and a very dark, necrotic-looking vagina. The infection

had evidently been an ascending one from the vagina.

The patient who died of peritonitis following a ruptured appendix, had had a spontaneous delivery at home 4 days before admission. Laparotomy under local anæsthesia revealed free pus in the abdominal cavity.

The patient who died from perforations of the small intestine, had a spontaneous delivery; but the day after delivery, her abdomen became markedly distended. The customary treatment was of no avail, and when a laparotomy was performed 8 days postpartum, much gas escaped from the abdominal cavity and perforations in the small intestine were found. The patient died the following day.

SHOCK

As was stated above, three patients died from shock caused by hæmorrhage and three died as the result of ruptured uteri. Of the patients who died from hæmorrhage one had an abruptio placentæ. She was admitted in a condition of shock, almost *in extremis*. A cæsarean section was immediately performed and a blood transfusion started soon after the incision was made, but the patient died on the table. A second patient who died of hæmorrhage was an elderly primipara who had a temperature of 101.2° during labor and who was delivered of stillborn twins by low forceps and version and extraction respectively. Because of bleeding, the placenta was removed manually and the uterus packed with gauze. There was profuse bleeding from the episiotomy wound as well as from the uterus, and the patient died on the delivery table. The third patient who lost her life because of hæmorrhage, had a spontaneous delivery and the estimated loss of blood was 1700 cubic centimeters. The uterus was examined postmortem and found to be intact.

On one of the three patients with ruptured uteri who died of shock, an abdominal hysterectomy was performed. In this case there was a rupture of one horn of a bicornuate uterus. The second patient who died of shock from a ruptured uterus was delivered with forceps by a midwife who not only ruptured the uterus but also tore the sphincter ani muscle. The third patient whose uterus was ruptured was delivered in the hospital. The accident occurred during a version after a forceps delivery had been unsuccessfully attempted, the patient having been in labor 51 hours. The latter two patients died shortly after the rupture occurred before an operation could be performed.

Of the four patients with ruptured uteri therefore, three died of shock while the fourth died of peritonitis following operation. In three of the cases the rupture occurred outside the hospital. On two, abdominal hysterectomy was performed, while two died before treatment could be instituted. The cause of uterine rupture for one case was forceps; for another, version; for a third, a long second stage. For the fourth the cause was unknown, the rupture having occurred outside the hospital and no definite information was obtainable.

ECLAMPSIA

Five patients died of eclampsia. Since there were during this period of time 46 patients with eclampsia the maternal mortality for this condition at the Chicago Lying-in Hospital and Dispensary was 10.9 per cent.

Two women who died had intrapartum and three had postpartum convulsions. All the patients had albumin and casts in their urine and the blood pressures ranged from 160 to 190, systolic, and from 82 to 110, diastolic. Strange to say, the number of convulsions varied inversely as the blood pressure. Thus:

	Blood pressure	Number of convulsions
Case 1	160– ?	14
Case 2	160– 86	11
Case 3	165– 82	9
Case 4	185–120	8
Case 5	190– 90	1

The first two patients listed above had spontaneous deliveries and developed convulsions postpartum. The first one was delivered at home and had fourteen convulsions before admission. The third woman was delivered by low forceps. A classic cæsarean section was performed on the fourth eclamptic because of her toxæmic symptoms, and she developed convulsions after delivery. The

last patient delivered a premature fœtus (780 grams) spontaneously after labor had been induced with a colpeurynter. The second patient had a mitral stenosis and insufficiency.

Venesection was performed on four of the five women and on one a spinal puncture was also done. Four babies were born alive, while the fifth was a still-born premature fœtus (780 grams). The live babies were small (2718, 2780, 2785, and the fourth unknown), and all were alive at the time their mothers died, which occurred on the first, second (two patients), third, and ninth days postpartum. The patient who had been delivered at home, was the wife of a man who subsequently married the former's sister and the latter also developed eclampsia but it was not fatal.

EMBOLISM

Two of the four patients whose deaths were attributable to embolism were up and about twelve and fourteen days respectively after delivery by low forceps. One had had a temperature of 102° for several days and one had manifestations of kidney disease. Both died suddenly, showing symptoms of embolism. A postmortem examination was made on one of these women and a large embolus was found occluding the tricuspid orifice. The embolus had its origin in a thrombus situated in the vena cava inferior and the latter in turn was an extension of a large thrombus which took origin in the left hypogastric vein.

The third patient passed away before delivery, while forceps were in place preparatory to the extraction of the child. Delivery was effected immediately after death but the baby was dead. Examination of the uterus revealed no rupture.

The fourth patient entered the hospital with an abruptio placentæ and because the bleeding had ceased, the cervix partially dilated, and uterine contractions were present, a Voorhees colpeurynter was inserted and a Spanish windlass applied to the abdomen. The colpeurynter was soon expelled and a stillborn fœtus and large clots of blood followed. The placenta was immediately expressed with great ease. The amount of blood lost was estimated at 1000 cubic centimeters. The patient left the delivery room in good condition. All through the puerperium there was a slight rise in temperature and during the last 8 days the pulse ranged between 118 and 124. She died on the [illegible] postpartum.

In all the cases but one, the placenta was delivered by Credé expression (that is, slight pressure was made on the contracted uterus after the placenta had separated completely and was lying either in the lower uterine segment or in the vagina). In the fourth case (the patient who died on the table), the placenta was removed manually after death.

Of the four patients three had had anæsthesia (ether) and three had been examined vaginally. Three were delivered by forceps while the fourth had a spontaneous delivery after induction of labor by means of a colpeurynter.

PNEUMONIA

The two patients who died of influenzal pneumonia, were admitted with the affection. The first entered the hospital with the fœtal head on the perineum and delivered spontaneously shortly after admission. The child, which was premature (1710 grams), was still born. The second woman had delivered spontaneously at home before the dispensary interne reached her. The entire labor had lasted 4 hours and 35 minutes, and the child was in good condition. The following day the patient was admitted to the hospital with a temperature of 104.2°. She died 2 days later of pneumonia.

The parturient woman who died of lobar pneumonia was a primipara who had a spontaneous delivery of a live child after a 22-hour labor. She was given only a few whiffs of ether. The day following delivery, pneumonia developed, and the patient succumbed to the disease 10 days later.

The fourth patient in this group was a dispensary patient who had had a spontaneous delivery, without anæsthesia, at home. She was admitted to the hospital the day after delivery with a temperature of 102.4°, and signs of bronchopneumonia. She died 2 days later.

CARDIAC DECOMPENSATION

Of the three patients who died of this complication, one was admitted in a state of decompensation, while in a second, decompensation began during labor, which was prolonged (5 hours). The entire duration of labor for the first patient was exactly 4 hours. Both women had mitral stenosis and insufficiency and in both, labor was spontaneous. Delivery in the third patient was accomplished by low forceps after a 17-hour labor, and death occurred 3 hours later in the presence of symptoms and signs of cardiac decompensation. Two patients were primiparæ, while the third was a sextipara. Two patients died on the day of delivery while the third passed away the day after delivery.

TOXEMIA

All three patients who died of toxæmia entered the hospital with outspoken symptoms of the condition. In one parturient the toxæmia was possibly of infectious origin. Two or three weeks before delivery, this patient contracted a cold and soon thereafter began to have delusions. She was admitted to the hospital because of her insanity and on entrance had a temperature of 100°, pulse 136, jaundice, blood pressure 115–65, and albumin and casts in the urine. She was 6½ months pregnant. Dr. Archibald Church, who saw the patient in consultation, made a diagnosis of toxic delirium and advised induction of labor. The membranes were ruptured and the cervix packed with gauze. This being ineffectual, a vaginal hysterotomy was performed without any difficulty. The placenta showed staphylococci in pure culture. The delirium ceased and the temperature, which was 103° at the time of operation, dropped. However, on the nineteenth day, just as the patient appeared to be entirely well, she died suddenly of what seemed to be an embolus.

One other patient had jaundice before delivery while the third developed icterus and also delirium the day after operation. All three patients had albumin and casts in the urine, but not one had convulsions. One patient had coffee-ground vomitus and a tender liver. Two women were in the seventh month of pregnancy. The third was near term but her baby weighed only 2748 grams (6 pounds). The latter had convulsions and was transfused. However, it died during a convulsion on the fourth day, which was the day of its mother's exitus. The other two fœtus, which were premature (1190 and 1219 grams), were stillborn. As regards treatment, a vaginal hysterotomy was done in one case while in the two remaining patients, a classic cæsarean section was performed under novocaine anæsthesia. In these women, the liver was small, of a yellow tinge, and looked like a liver in the first stage of acute yellow atrophy. The patients died on fourth, sixth, and nineteenth days after operation. An autopsy on one woman disclosed no local infection.

CORONARY THROMBOSIS

The patient with this condition like the other patients with cardiac disease, had a mitral stenosis and regurgitation. She was a primipara and her labor, which lasted a little more than 5 hours, was terminated with mid-forceps. She died on the ninth day postpartum and autopsy revealed a coronary thrombosis.

STATUS LYMPHATICUS

An 18-year old primipara was delivered by mid-forceps after a 25-hour labor. An episiotomy had been performed and because of hæmorrhage, the placenta was removed manually. The patient died suddenly while the episiotomy wound was being repaired. An autopsy was performed and the thymus and mesenteric glands were found to be enlarged. Pulmonary œdema was also present.

A REPORT OF FIVE UNUSUAL CASES OF HYPERTENSION IN PREGNANCY

[illegible] WILLIAMSON, M.A., M.D.
[illegible]

An increase of blood pressure in a pregnant woman is commonly the most ominous sign of impending toxæmia and always causes the obstetrician concern from the moment the disturbance is noted until the patient has been delivered. Starling (1) remarked that any systolic pressure of 125 in pregnancy would make him feel that the pregnancy was not quite normal and would put him on the lookout for some degree of toxæmia. It goes without saying that a high blood pressure in pregnancy carries with it more danger than in the non-pregnant state. Ringer (2) considers every case of hypertension a potential nephritic. Irving (3) in a study of five thousand pregnancies reports that 80 percent of the cases had a systolic pressure not exceeding 130. It is probably fair to assert that a systolic pressure of 150 or more in pregnancy should be considered pathological in the majority of patients. Weber (4) suggests that a constant systolic pressure of 160 or more is the dividing line and pathological limit. It cannot be forgotten, however, as Faught (5) has demonstrated that some women show a persistent high blood pressure and at no time present a picture of toxæmia. Such cases are to be observed carefully, but they do not fall under the class necessitating surgical interference, and they are to be distinguished from the pregnant cases showing even a moderately high blood pressure accompanied by all or some of the familiar signs of toxæmia.

The five cases reported are presented because all occurred in pregnant women under 30 years of age, with a minimum systolic pressure of 180 to 240 prenatally, and a pressure of 170 to 240 postpartum. The various results of the blood examinations and functional tests seem quite out of harmony with the degree of hypertension.

Case 1. Mrs. S., 28 years old, was in her second pregnancy, and at the beginning of her sixth month [illegible]. She is said to have had severe pyelitis during her [illegible] pregnancy. [illegible] uneventful and she delivered speedily and normally. Her convalescence was uneventful.

Case 2. Mrs. W. [illegible] pregnancy at the beginning of the seventh month. [illegible] cystitis in preceding pregnancies. She went through an apparently normal pregnancy [illegible] easily after a rapid labor. Her convalescence [illegible].

Case 3. Mrs. L. [illegible] pregnancy and at the beginning of her sixth month. [illegible] irritable and subject to frequent headaches. There [illegible] relieved the trouble promptly. She had a long, slow labor and was delivered easily with forceps [illegible] dilatation because of delayed second stage. Her convalescence was uneventful.

Case 4. Mrs. R., a primipara, 28 years old, was [illegible] seventh. During pregnancy she was easily excited and inclined to become hysterical at the slightest provocation. She complained [illegible] aches and dizziness but was otherwise well. After a moderately severe labor she was delivered with low forceps because of fœtal distress. Her [illegible] not remarkable. This woman had a family history of hypertension and in addition had definitely diseased tonsils.

Case 5. Mrs. M., 23 years old, and in her second pregnancy, was first seen when [illegible] pregnant and had come for examination at this early date because her first pregnancy had terminated in a miscarriage at 4 months. From the beginning, she complained bitterly of nausea and vomiting together with right-sided headaches, which she said made her "blind." Rest in bed with high carbohydrate feeding and sufficient catharsis practically [illegible] at the end of 4 months. Her stay in the hospital was [illegible].

The patient gave a history of frequent attacks of tonsillitis until a tonsillectomy had been done 2 years previous. There was enough physical evidence to suggest a diagnosis of mitral stenosis.

Of the [illegible] postpartum, the first three patients seemed perfectly well and were living normal lives. Patient number [illegible] coronary embolism. Patient number four entered the [illegible] 6.

gave a history of a severe nervous shock on the morning before entrance. A severe headache came on, followed almost immediately by a generalized convulsion. Venesection was performed by the physician summoned and some time later she was removed to the hospital. She complained bitterly of pain in her neck and also of occipital headache. Her vision in the left eye was obscured by a massive retinal hæmorrhage covering the disc and the vision in her right eye was disturbed from a similar cause. At this time her blood pressure was 150-80. The urine was negative except for the slightest possible trace of albumin. Lumbar puncture revealed a bloody fluid under pressure but otherwise negative. The blood was considered to be in the spinal fluid and not a result of faulty technique. Her headache was immediately relieved after the puncture. The patient seemed to be suffering from a definite vascular crisis of the cerebral type and in the course of a few days developed some paralysis of the right hand and foot, a definite speech disturbance together with a mental upset. She could be considered a case of cerebral apoplexy with the final result still in question.

The first three patients were approximately 5 feet 8 inches tall and weighed between 150 and 160 pounds. Patient four was 5 feet 2 inches tall, weighing 160 pounds, shortnecked and plethoric. This particular woman would worry over the merest detail and was easily disturbed by unimportant detail. The fifth patient was 5 feet 9 inches tall, thin almost to the point of emaciation. Moschcowitz (6) remarks that the "type" individual is commonly overweight, shortnecked, unathletic; that she is physically prematurely old and lacks the ability to play either mentally or physically. According to this description patient four is the only typical case in the series.

The physical examinations in the first three cases were negative. The last two patients had markedly thickened arteries with a definite leathery feel to the palpating finger, and this in spite of the fact that roentgenographs showed no marked sclerotic changes in the vessels. Case 4 had a definite cardiac hypertrophy and Case 5 presented evidence suggesting mitral stenosis.

All patients were given the same prenatal care, advised to drink ten or more glasses of water daily, to rest morning and afternoon, lying down for at least an hour, and to avoid strenuous exercise. The diet was restricted comparatively little with the exception that meat, fish, and eggs were allowed only once daily. Extra salt and the use of condiments were forbidden and a high carbohydrate diet urged. The blood pressures were taken every fifth day and the times of reading the pressure were different to note whether the time of day made any difference or not. The urine was examined every third day. For a laxative, fluid extract of cascara was recommended, one half drachm twice daily, and in every case it was effective. At delivery the placentæ showed no gross changes indicative of either a nephritis or any toxæmia.

The Wassermann in each case was negative.

The age incidence in this series is rather remarkable.

Woley (7) gives the normal range of blood pressure between the ages of 15 and 30 as 103 systolic, to 140 with an average reading of 122 millimeters of mercury. Janeway (8) found 80 to 90 percent of all patients with hypertension to be between the ages of 40 and 69. Weber (9) says that for insurance purposes he considers every person who may at any one examination have a systolic pressure of 200 or over, as far as life assurance is concerned, as an applicant of 70 years, although, as a matter of fact, he may be well under 50.

The physical makeup of the patients was atypical with the possible exception of Case 4. None of the patients was overweight and none was of apparently nervous temperament. All were seemingly in the best of health enjoying life, and would never have consulted a doctor were it not for the fact of pregnancy. All were happily married and had no particular worries, either economic or otherwise. The blood pressures were taken with a mercury column using the auscultatory method. The readings were made at different times to attempt to discover an essential variation. All postpartum figures and tests were made at least 3 months after delivery. All the patients were put to bed for a five-day rest and in not a single instance did the pressure diminish, indeed in Case 5 there was a rise to 250, despite the fact that the patient was content and quite willing to stay in bed. Case 4 showed a drop in pressure to 135-70 after delivery but there

was a gradual increase until the fifth day post partum when the pressure was back to its original figure. The other four cases showed no marked change following delivery, the figures remaining practically stationary.

TABLE I

Case	1											
Para	II		V								II	
Age												
	A.P.	P.P.	A.P.	P.P.	A.P.	P.P.	A.P.	P.P.	A.P.	P.P.	A.P.	P.P.
N. Prot. N.												
Urea												
Uric acid												
Creatinin	1.2	.6	.8									
Sugar	80			84	76							

The blood chemistry is interesting, there being no marked increase in the non-proteid nitrogen, urea nitrogen, uric acid, creatinin or sugar, either before or after delivery. Even in Case 5 who died shortly after being seen for discharge visit and only a short time after the blood was taken for chemical analysis, there was nothing to indicate a sudden decease. The higher sugar figure post partum in Case 4 was due to the fact that she was getting an excess of glucose over a period of days as part of her treatment following the onset of apparently acute uræmia as previously mentioned. The blood clots show no particular change either before or after delivery. Werner (10) insists that in pregnant women, with an oncoming toxæmia or any kidney disturbance, chloride excretion is one of the first things to indicate the change. In prenatal periods according to his figures 7 to 26 grams of chlorides may be excreted normally in the urine daily and postpartum 11 to 21 grams may be excreted. It can at once be seen that the figures here are at the upper limit of his estimation but that a comparison of the blood chlorides and urinary chlorides places them well within normal limits. From the reports here the only conclusion which can be drawn is that, as far as the individuals are concerned, there is a perfect compensation, so to speak, and hence there is no remarkable change in blood chemistry. This fact is further borne out by the presence of an elevated pulse pressure, proportionate to the hypertension demonstrating that the vascular system is still competent to carry its load. According to Norris (11) the pulse pressure of all five cases would be considered pathological, for he insists that any pulse pressure as low as 20 or as high as 60 is definitely pathological. Statements in regard to pulse pressure as prognostic are hard to interpret. Erlanger and Hooker (12) have shown experimentally that the secretion of urine varies directly with the pulse pressure. It is certain that the urine too must be definitely dependent upon flow through capillary vessels of the kidney and when we attempt to interpret pulse pressure prognostically with such an understanding we are met with the statement of Wiggers (13) who writes that blood flow through capillaries can be gauged neither by the height of arterial pressure nor by their different pulse pressure. In addition Skelton (14) by experimental work has demonstrated that any attempt to draw conclusions as to the output of the heart by a determination of pulse pressure and pulse rate is fruitless. Albutt (15) indicates that the pulse pressure should bear a relationship to the systolic pressure of approximately 1:4. It is fair to state that the pulse pressure may be of value for, with so many factors entering into the question, a cardiac disturbance will usually show fairly promptly in pulse pressure when actual cardiac efficiency is in question.

For the index of kidney function I employed the phenolsulphonephthalein test since it is perhaps the best we have for determining total renal function. Piersol (16) asserts that in normal individuals, the total phthalein output at the end of the test should amount to between 50 and 70 per cent after the intramuscular injection of the dye. A glance at Table II suffices to show that as far as phthalein function is concerned the five patients had normal kidneys.

Frothingham (17) feels that one of the best evidences of disturbed renal functions is the delayed elimination of chlorides in the urine. I did not have the courage to add even 10 grams of salt to the diet before delivery lest a crisis be precipitated, but waited until after

delivery to attempt the test. As has been remarked before in a previous paragraph in connection with blood chlorides, the amount of chloride excreted in urine was within the normal amount usually found postpartum.

The fear of an impending toxæmia forced me to insist upon the ingestion of large amounts of fluid daily with the idea in mind of keeping the kidney well washed out. The amount of fluid excreted daily is all that we could expect from any kidney. With the large amount of fluid taken in, there was without doubt a moderate diuresis and this is quite in keeping with the work of Priestly (18) who demonstrated that the diuresis consequent on water drinking is probably accompanied by changes in the blood, a slight dilution, and a passage of salts and possibly proteins out of the blood. His results coincide with the excretion here and his explanation is that the regulation of the excretion of water by the kidney is of a two-fold nature, that is, a main regulation dependent on the diffusion pressure of water in the blood and a subsidiary modification of this regulation dependent on the ability of the kidney to hold back water when the diffusion pressure of water in the urine is considerably below that in the blood.

TABLE II

Case	1		2		3		4		5	
	A.P.	P.P.	A.P.	P.P.	A.P.	P.P.	A.P.	P.P.	A.P.	P.P.
Phthalein	81	54%	47%	55%	45%	42%	42%		9%	11%
	22%	15%	20%	21%	30%	33%	29%		57%	52%
	73%	79%	67%	73%	75%	65%	71%		66%	63%
Blood pressure	182	178	190	170	200	170	220	220	142	146
	110	108	125	110	120	110	120	120	110	110
Pulse pressure	72	70	65	60	100	60	105	110	146	110
Fluid intake	2000 c.cm.	2000 c.cm.	2000 c.cm.	2200 c.cm.	2400 c.cm.	2000 c.cm.	2800 c.cm.	2600 c.cm.	2000 c.cm.	2000 c.cm.
Fluid output	1920 c.cm.	1110 c.cm.	1750 c.cm.	1200 c.cm.	1640 c.cm.	1580 c.cm.	1850 c.cm.	1150 c.cm.	1770 c.cm.	1190 c.cm.
Blood chlorides	7.0	6.9	7.1	7.2	6.8	6.6	8.8		7.2	7

The two-hour specific gravity test on the urine was carried out with the fact in view that the variation in specific gravity is dependent directly upon the ability of the kidney to eliminate water normally and at the same time excrete certain inorganic salts and organic waste products commonly occurring in the urine. Mosenthal's mandate (19) that the patient should be taking the usual quantity and quality of food was obeyed. A glance at Table III will show that in the instance of Case 5 there was quite evidently a fixed, low specific gravity. A low fixed gravity usually means that the kidneys have lost their power to concentrate and are unable properly to excrete certain solids. Piersol (20) writes that such a condition commonly occurs in chronic glomerular nephritis and also where there is marked anæmia, diabetes insipidus, and during the elimination of œdema.

TABLE III

Case	Two-hour specific gravity test						Chlorides in the urine
1	A. P.	1.012	1.016	1.020	1.026	1.020	1.012	21.268 gr.
	P. P.	1.006	1.012	1.015	1.018	1.016	1.014	
2	A. P.	1.010	1.015	1.020	1.022	1.018	1.016	20.133 gr.
	P. P.	1.015	1.012	1.021	1.016	1.020	1.016	
3	A. P.	1.015	1.016	1.024	1.022	1.021	1.016	22.106 gr.
	P. P.	1.009	1.012	1.018	1.020	1.016	1.012	
4	A. P.	1.008	1.020	1.006	1.002	1.030	1.026	19.128 gr.
	P. P.	1.010	1.024	1.010	1.010	1.014	1.020	
5	A. P.	1.006	1.010	1.016	1.012	1.010	1.012	21.736 gr.
	P. P.	1.008	1.008	1.010	1.012	1.014	1.012	

OUTCOME OF CASES

The outcome of the cases is interesting. Austen (21) has written that an individual may carry for years a systolic blood pressure of two hundred or more without symptoms subjectively. Verdon (22) insists that the blood pressure may be high for years and that individuals under his own notice have been observed for a period of 10 years with no change in the figures and no untoward symptoms. Janeway (23) reports a death rate approximately of 30 per cent in cases with a systolic pressure of 170 or more, the survey coming 8 years after the primary observation. Topp (24) reports a much higher figure than this. It is to be remembered too that none of these figures was reported in pregnant cases and that the age range was from 40 to 70 years.

Of this series, one died a cardiac death, one had a vascular crisis of the cerebral type but the other three cases are living and well. Of course the usual listing of causes of death in cases of this type is in the order of frequency cardiac, cerebral, and nephritic.

DISCUSSION OF ETIOLOGY

The question immediately arises as to what the primary lesion may be. I believe these cases to be primarily vascular in origin with hypertension as the first evidence of disturbance and the possible nephritic changes as secondary.

Moschcowitz (25) insists that hypertension is a symptom and not a disease entity and on the other hand is the statement of Albutt (26) who terms arteriosclerosis the effect of persistently high blood pressure. Its relationship to nephritis has been observed since the days of Richard Bright and the preponderance of modern medical thought seems to be with Ringer (27), who considers every hypertension case a potential nephritic. The close connection between hypertension and nephritis apparently is confirmed by repeated autopsy reports, such as for example that of Lee (28) who found kidney lesions in 71 per cent of all cases of hypertension and in every case with a systolic pressure of more than 200. We must not lose sight of the fact, however, that there are some cases of high blood pressure which show practically no renal damage, despite the fact that such evidence as that presented by Lee just mentioned that every case with a pressure of over 200 constantly has renal lesions. It is fair to assume with Williams (29) who writes that when arterial hypertension is uncomplicated by nephritis or cardiac decompensation and gives no functional evidence of kidney insufficiency, when there are normal kidney excretions and normal nitrogen values in the blood, we are not justified in making a diagnosis of nephritis. If nephritis were the primary cause of all cases of hypertension, we should expect to find renal damage proportionate to the elevation of pressure, when, as a matter of fact, repeated autopsies have shown this is not the rule. I believe in this series that hypertension is the primary phenomenon with nephritis and scleroses as the secondary changes. The albuminuric retinitis, for example, is a phenomenon probably duplicated in the kidney as far as vessel changes are concerned. The various clinical disturbances are the results of vascular changes. As Austen (30) says: "The nature of the first symptom varies and is possibly dependent upon the vascular abnormality in the various viscera." These cases still happen to be well compensated as is evidenced by the facts of an increased pulse pressure, a variable specific gravity and a sufficient elimination of urine. Warfield (31) observes that an elevated pulse pressure is not only compatible with health but probably is an evidence of compensation in hypertension.

The blood vessels play an active part in contracting and dilating and so maintain pressure rather than by mere mechanical elasticity. Physiology has repeatedly demonstrated the dilatation and contraction of vessels due to mechanical, physical, chemical, or mental nature. The various symptoms occurring in these cases of hypertension are perhaps due to disturbance of blood supply of kidney, heart and brain. The integrity of the kidney as a filter against albumin depends on the adjustment of the blood supply. The action of the kidney and its eliminating work has recently been shown by Richards (32) in an ingenious way. He quite easily demonstrated the glomerular action with changes of blood flow, with elimination following correspondingly. The reserve power of the kidney is the reason why so many changes can be going on with few or no symptoms and little or no functional disturbance. Haidenheim (33) long ago expressed the idea that secretion in the kidney is not definitely dependent on blood pressure but rather to the actual amount of blood passing through the kidney. The rise in pressure is compensatory and forces sufficient blood through the capillaries. Norris (34) states, "A rise in general arterial blood pressure caused by increasing the total bulk of the blood or by augmenting the cardiac output increases the blood flow through the kidneys and consequently renal activity. Experimentally (35) the evidence shows that the reduction of kidney substance to one-fourth normal will give a rise in blood pressure, but the work of Moschcowitz demonstrates that the arterial tree plays by far the major rôle in the numerous cases of hypertension with minimal renal lesion.

The effect of amyl nitrite in these patients further confirmed our belief that the primary

lesion was in the blood vessel. Rzentkowski (30) found in arteriosclerotic patients a greater and more prolonged lowering of the blood pressure despite the increased cardiac activity. The nitrite was inhaled and in the first three patients the average drop was 25 millimeters with a return to normal in 4 minutes. In Case 4, the drop was 25 millimeters, but it was 9 minutes before the pressure returned to its original figure. Case 5 dropped 30 millimeters and was 8 minutes in returning to the original figure, during which time there was labored breathing, cyanosis, and rapid pulse. The difference in response is due to the fact that the sclerotic artery has lost its elasticity.

Wheelon (37) considers hypertension functionally the result of an increased peripheral resistance, a resulting reflex, either of chemical or toxic nature, working directly upon the blood vessels and vasomotor apparatus, and this is practically a restatement of the views of Allbutt (15). Jores (38) says that the lesion consists of a pronounced thickening of the intima of the vessel-wall due first to hyperplasia of the elastic tissue and then subsequently involving the other intimal tissues.

In this particular group of cases the toxic theory of primary injury to the blood vessels seems most pertinent. Cases 1 to 3 are said to have been repeatedly troubled with pyelitis and cystitis although during these particular pregnancies I was unable to demonstrate their presence. Case 4 had distinctly infected tonsils and was under the care of a laryngologist. Tonsillectomy was contemplated but her sudden cerebral seizure interfered. Case 5 presented repeated tonsillitis, a sufficient toxic cause. Shaw (39) feels certain that there are poisons circulating in the blood and causing high pressure by their irritating effect but that they are in no way expressive of kidney action. Such a toxic theory also seems borne out by the work of Okuma (40) who demonstrated vascular changes and acute or chronic glomerular nephritis by the intravenous injection of venom from a crotalin snake.

CONCLUSIONS

1. Hypertension may exist throughout pregnancy with no apparent sign of kidney lesion.

2. Some cases of hypertension in pregnancy may be carried through to a successful termination with careful watching.

3. Cases in pregnancy with hypertension without demonstrable kidney lesions are probably of vascular origin.

4. The most likely cause of such hypertension is that it is of toxic origin with the primary action taking place directly in the arterial wall.

5. The prognosis of such cases is always grave and doubtful both for immediate and subsequent life and the patient should appreciate fully the import of hypertension.

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Note.—Since submission for publication Case 4 has practically recovered with the exception of impaired vision and her blood pressure is 190–100, with all other findings substantially the same.

RADIUM VERSUS OPERATIVE TREATMENT OF FIBROIDS

By N. SPROAT HEANEY, M.D., F.A.C.S.

THERE is a growing impression among physicians that all cases of fibromyomata of the uterus should be treated with radium. I, myself, am not of this opinion, but believe that surgery should be used in the largest proportion requiring treatment, while radium should be used only in a small proportion of cases and those should be well selected.

In order to indicate my own opinion, I have briefly looked over my last hundred cases operated upon and will compare them with the cases treated with radium during the same interim. I find that during the period I operated upon 100 women, I administered radium to only 8 cases of fibromyoma. The youngest case operated upon was 25 years, the oldest 56, and the average age was below 40. The ages of the radium cases will be given when we detail their histories. In brief, we advise against radium in women under 40 unless poor operative risks, since we believe the retention of ovarian function in young women is important if it can be obtained by leaving sound ovaries in. It seems curious to hear a clinician advise extreme measures to conserve ovarian tissue in his operative work and then later see him totally disregard normal ovarian tissue by advising radium for the treatment of a fibroid in a young woman. Amenorrhœa cannot be produced nor can a fibroid be reduced appreciably in size without producing destruction of ovarian tissue.

Among the cases operated upon we had one death due to pulmonary embolus. This patient was 30 years old and except for the very large pressure-producing fibroid, was otherwise well before operation. In these 100 cases, it would give us a mortality of 1 per cent. We looked back through the records for the 200 preceding cases operated upon, however, and found no deaths in that number. Had time permitted in the preparation of this paper, it would have been instructive perhaps to find out my operative mortality during the last 10 years. The figures at hand, however, are conclusive enough to show that the mortality rate of operation quoted by the ardent advocates of radium therapy is entirely too high. None of the cases treated with radium died.

The operations performed were: vaginal removal of pedunculated fibroids from the uterine cavity, either by morcellation or cervical incision, 7 cases; abdominal myomectomy, 15 cases; vaginal myomectomy, 1 case; resection of the fibroid-bearing portion of the uterus, 4 cases; supravaginal hysterectomy, 22 cases; complete removal of uterus with cervix by the abdominal route, 41 cases; vaginal hysterectomy, 10 cases.

In 56 cases either one or both ovaries were left in. These were all normal appearing ovaries. In only one case was only a portion of ovary left. In 44 cases both ovaries were removed. In 56 cases, then, normal ovaries were conserved for the patient — a result that could not be accomplished with the use of radium. None of these retained ovaries, as far as we know, has caused the patients any subsequent trouble.

Among these cases operated upon we found two cases of gall stones and in one an unsuspected beginning appendicitis. Two diabetics were operated upon. Radium was suggested for the control of the hæmorrhages in both these cases, but we voted for operation because they were otherwise sound, were at the time sugar-free, and we felt that they could better overcome the effect of a quick operation under gas and oxygen anæsthesia than they could the burn and infection of the endometrium after an intra-uterine radium administration. We had one case of unsuspected carcinomatous polyp complicating a pedunculated fibroid of the uterus. This case we reported to you at a former meeting of this society.

A few words regarding operative morbidity, for this is also an important point in deciding between radium and operation.

Read before the Chicago Gynecological Society, February 17, 1922. (For discussion see p. [illegible])

One patient developed a temperature of 105° F. and had marked tenderness over the uterus. She was quite ill for 3 or 4 days, but left the hospital shortly after the usual stay. This case had an extensive myomectomy and there was, no doubt, infection of retained wound secretion. She would have done better with a hysterectomy, but it was highly desirable, in this particular case to retain the uterus. Two cases had embolic pneumonia, delaying somewhat their recovery. One patient developed a small abscess in the pelvis following a complete hysterectomy. Opening up the vaginal vault allowed the escape of infected blood and the convalescence then was rapid. One case was a re-operation of a former resection of the uterus. Adenomatous tissue was left in the uterine remnant and such pain was produced by the retained menstrual secretion that a hysterectomy was performed. The patient has since been free of pelvic pain. One patient shortly after a hysterectomy returned with pyelitis. No ureteral stricture was present and the pyelitis lasted but a short time.

When selecting a case for radium, we select as an ideal case one in which bleeding is the principal symptom, where the uterus is not too large, rarely larger than an infant's head (the smaller, the safer), and where the maintenance of ovarian function is not essential. If a patient is a good operative risk, we prefer to operate if the above conditions are not present. The poorer the operative risk the more we must depart from the above ideal; for example, we treated a large fibroid with radium in a young woman who had a very serious heart lesion. We advise against radium where evidences of imflammatory reaction exist in the pelvis; also, and this is important, where the fibroid does not account for all of the patient's complaints. Other operative conditions may exist which will keep the patient from feeling well even if the radium treatment relieves the fibroid symptomatology; for example, a plastic may also be necessary.

The eight cases which I report here were, for the large part, poor operative risks. I am presenting the paper to elicit your discussion, so I will briefly describe these cases.

Case 1. A newly married woman of 42 with a symmetrical fibroid extending to umbilicus. Ergot failed to relieve depleting hæmorrhages. The heart gave evidences of beginning broken compensation. One treatment of 1200 milligram hours was given. The fibroid, 3 months after treatment, was the size of a fœtal head. She has not menstruated since.

Case 2. Very nodular uterus the size of a fœtal head in a woman of 44. General physical condition, except for menorrhagia, was good—no other operable conditions were present. There had been two operative deaths in immediate family, so patient had great fear of operation. No contra-indication to radium was present, and 1200 milligram hours of radium were given. The uterus is now one-half oversize, amenorrhœa.

Case 3. Patient, age 45; suffered with menorrhagia. The uterus was the size of a fist, and very irregular. No contra-indication to radium. No operable condition present. A small polypoid intra-uterine fibroid was removed by torsion and 1200 milligram hours of radium given. Patient suffers from marked hot and cold flashes and amenorrhœa.

Case 4. Patient, age 45; extremely fat and puffy; with no definite contra-indications to operation except extreme obesity. No other operative condition present. Twelve hundred milligram hours of radium were given. One year later amenorrhœa and the uterus was about normal size.

Case 5. Spinster, age 49, suffered with menorrhagia. She was a good operative risk. A pedunculated fibroid the size of a duck egg was removed by morcellation from the interior of uterus and 1200 milligram hours of radium given. The patient was well 3 months afterward but has not been seen since.

Case 6. Woman, age 46, had never been pregnant, and was frail and delicate. She suffered with paralysis agitans, and menorrhagia. Except for a fist-sized uterine fibroid, the pelvis was negative. Twelve hundred milligram hours of radium were given. She returned without symptoms in one year for re-examination and an ovarian cyst the size of a fœtal head was found. Operation was advised, but refused.

Case 7. Woman, age 50, with dilated heart; blood pressure, 210; multiple abscessed teeth; and fibroid extending to umbilicus. Complained of menorrhagia as the only symptom. An egg-sized fibroid was removed by morcellation from the uterine cavity and 1200 milligram hours of radium given. A few weeks later she had a brisk hæmorrhage of brief duration. The abscessed teeth were subsequently removed. One year later the uterus reduced to about three times normal. It pressed against the bladder and produced frequency. Small showing of blood on two occasions close together. Blood pressure, 160. General health was excellent. A curettage for diagnosis was done and 900 milligram hours of radium given. The uterus now, 6 months later, is normal in size. Amenorrhœa. Patient has

a stricture of the left ureter [illegible] acute pyelitis with distention of ureter and kidney—quite possibly, in my mind, due to the radium producing an injury to the ureter in the region of the broad ligaments.

Case 8. Patient, age 35, with marked hyperthyroidism. She had recently had a thyroid operation. Myocarditis. Menorrhagia. The uterus was small. A small polypoid fibroid was removed from the interior of the uterus, and 900 milligram hours of radium given. [illegible] treatment and no menses have occurred. She has some hot and cold flashes.

You will see that I believe that [illegible] very few cases of fibroids [illegible] well treated with either radium or operation. However, a study of a [illegible] show that usually a decided preference for one of these treatments can be shown to exist.

THE DIAGNOSTIC AND CLINICAL ASPECTS OF GONORRHŒAL SALPINGITIS[1]

By HENRY SCHMITZ, M.D., F.A.C.S., Chicago

THE clinical importance of gonorrhœal infections of the female genital tract was probably first recognized by Noeggerath, in 1872 (1). The scientific proof for the observation was rendered when Neisser discovered the gonococcus in 1879 (2). The former took one hundred cases of women who became wives of men who had gonorrhœa and scarce ten remained healthy. "A woman who at any time has had gonorrhœa, has to expect at some more or less distant period it may be a month or a year a subsequent attack of peritonitis in some form. The young, hitherto healthy wife begins to complain a few weeks after marriage. Menstruation commences to be more profuse than formerly, accompanied by dysmenorrhœa and leucorrhœa more or less excessive, especially at periods, followed by severe pains on both sides in a few months. Ultimately she is forced to go to bed, is confined for weeks or months, and remains sterile and an invalid for the rest of her life."

Noeggerath concludes that (1) gonorrhœa in man or woman persists for a whole lifetime in spite of apparent cure; (2) latent gonorrhœa occurs in woman as well as in man; (3) latent gonorrhœa in woman as well as man may evoke an acute attack; (4) latent gonorrhœa in woman manifests itself in the course of time by acute, chronic, or recurrent attacks; (5) the wives of men who, at any time of their lives, have had gonorrhœa are sterile as a rule.

These dicta established at once the clinical importance of gonorrhœal infections of the female genital tract. Since then the disease has received the attention of the best medical minds with a view of bringing about prevention and cure of the scourge.

Gonorrhœa is one of the oldest venereal diseases indigenous to the human race. Of all the known micro-organisms pathogenic for the human organism, the gonococcus has attained the highest degree of parasitory adaptation. It is essentially a mucous membrane parasite, grows only on the mucosæ of humans, and enters the epithelial mucous surface without the latter having sustained a preceding loss of its continuity by trauma, ulcerations, and so forth. The route of infection is always an ascending one. The primary infection ordinarily occurs in the vulva in the virgin and in the cervix in the deflorata. From either place the gonococcus spreads in an upward direction, halting at the internal os uteri, which barrier is usually passed at one of the next menstrual periods. The parasite then invades successively the endometrium, the uterine tubes, and finally the pelvic peritoneum and ovaries.

The demonstration of the presence of the gonococcus in the discharge from the genital organs is positive evidence of the existence of a gonorrhœal infection. In recent cases it is easily done; in chronic cases it offers almost insurmountable difficulties. The various procedures recommended for diagnostic pur-

Read [illegible]

poses are microscopic examination of stained smears, cultures and tissues removed from the suspected person, the complement fixation test, and the diagnostic vaccination test.

The diagnostic value of these various procedures has been discussed in many valuable medical literary contributions. Bumm (3) states that the culture of the gonococcus has not given any better results than the microscope. He has never obtained gonococci on cultures, if he had not found them previously in a microscopic examination of a stained smear. The detection of the gonococcus in the tissues of the diseased mucosæ is one of the most time-wasting procedures of microscopy. Norris (4) says when gonorrhœa is latent, the passage of a catheter into the urethra or a slight dilatation of the lower cervical canal will set up a mild traumatic irritation in the discharge from which the organism can often be easily demonstrated. The suspected area can be touched with a stick of solid silver nitrate for the same object.

Van de Velde, quoted by Norris, states that a diagnostic vaccination often produces an increased secretion in which the gonococci are more numerous and are often thus easily found when they could not be previously demonstrated.

In chronic or latent cases three or four slides should be made from the suspected locality and be repeated on 3 successive days. If it is impossible to demonstrate by slides, cultures should be made. A complement fixation test once positive and followed by a negative reaction later on is of great value in estimating a cure.

L. E. Schmidt (5) states that results indicate that a negative reaction obtained with the complement fixation test shows good evidence that the disease is cured. In gonorrhœal histories of from 1 to 10 years, he got 92 per cent negative results. It must be remembered that gonococcal antibodies exist some time after the gonococcus dies or disappears.

Irons (6) affirms that a subcutaneous injection of dead gonococci in persons suffering from gonorrhœa was followed in from 12 to 24 hours by a local and general constitutional reaction. The reaction consists of an area of redness, swelling, and tenderness at the site of inoculation; often increased pain and tenderness in the affected joints and other localizations, together with malaise, increase of fever, and a leucocytosis. This is similar to the tuberculin reaction and is shown to be of value in the diagnosis of obscure cases where gonorrhœa is suspected. Reiter (7) observed this reaction in women suffering from pelvic inflammatory disease of gonococcal origin. Irons states that in positive cases a small area of hyperæmia develops at the site of inoculation.

Sternberg (8) concludes, after an extensive study, that diagnostic vaccination is of much practical aid in the diagnosis of latent cases of gonorrhœa.

Jacoby (9) says that in chronic gonorrhœa in a suspect, smears should be taken just before or immediately following a menstrual period. He dilates upon the necessity of repeated smears. He would consider a case a chronic gonorrhœa where there is a history of gonorrhœa or where there is clinical evidence of a former case in which the smears showed numerous pus cells without gonococci. He would treat it as such. He considers a case as cured only when all inflammatory discharges have ceased. At least six smears taken in succession must be negative. The smears are to be taken from the cervix, urethra, Skene's ducts and Bartholin's glands just before or just after a menstrual period. A smear should also be negative after a provocative injection into the urethra. The gonococci complement fixation test shall be negative. Re-examinations comprising all the above steps and made at the end of one month should also be negative.

Neverman (10) injects 0.4 to 0.5 aolan intracutaneously. The following morning slides are made of the cervical discharge. He claims that it increases the gonorrhœal discharge and that where gonococci are few, they become greatly increased in numbers. The injection causes a skin reaction similar to Irons' vaccination with dead gonococci. There also is a slight general reaction.

Smith and Wilson (11) assert that the complement fixation test is of undoubted value in chronic gonorrhœal infection. None but gonorrhœics give a positive reaction.

In 82 per cent of suspected cases they get a positive reaction, and in 14 per cent a weakly positive reaction, and in only 4 per cent a negative reaction. In their controls of 53 cases, clinically negative to gonorrhœa, they got 100 per cent negative results.

Neisser has suggested the following method of examination for gonorrhœa in women: Insert in the urethra a long-handled, blunted, thoroughly heated "sharp spoon" for the purpose of scraping off the most superficial layers. If Bartholin's gland is the seat of the gonococcus in chronic cases, the stoma is surrounded by Saenger's "maculæ gonorrhoicæ." The mucous secretion may then be expressed and the micro-organism found in it. The cervical canal is slightly dilated after removal of the mucous plug. Microscopic specimens are then prepared from scrapings of the wall lining.

The procedure carried out in our clinic is essentially the same as that of Neisser. If gonococci are not found microscopically in stained smears, then the diagnosis is made solely from the history of the case. When a hitherto healthy woman develops in the first year or so of married life an ascending endometritis and adnexitis it is gonorrhœal in character. Ascending tuberculous and colon bacilli infections are rare. The clinical picture and objective findings also enable one to exclude such infections.

The gonococcus, after being deposited on a mucous membrane, penetrates all the layers of the epithelium. The micro-organisms are arrested in the superficial layers of the connective tissues, and never found in the deep connective tissue, although inflammatory changes are found in this layer. The infection is accompanied by an abundant discharge, a profuse formation of pus cells, and round cell infiltration. Hence the infection is mostly a superficial process. If the mucous glands become involved the infection remains localized in the most superficial layers of the gland ducts. The epithelium of the glandular tubes appears to possess an immunity against gonorrhœal infection.

In acute gonorrhœal salpingitis, the mucous membrane is a deep red and covered in places with pus and fibrin. Otherwise the tubal wall does not show any changes. The tube is soft, not thickened, and freely movable.

If the infection continues, agglutination of the fimbriæ and closure of the abdominal ostium occur and the organ becomes adherent to the neighboring tissues and organs. The tube usually surrounds the ovary and becomes fixed laterally and posteriorly to the uterus and the Douglas pouch. Omentum and loops of bowels are frequently attached to such a tubo-ovarian tumor by fibrinous adhesions. The serous layer is covered with a fibrinous exudate, and the endothelium beneath this is destroyed. The wall becomes thickened and rigid by hyperplasia of the connective tissue and irregular round cell infiltration occurring in places. The mucous folds are thick and densely infiltrated with round cells. A purulent softening of the mucosa is seen in places. Often the entire epithelial cover of the tube is gone, granulation tissue appearing in its stead. A spontaneous cure of the process is still possible at this stage by resorption of the pus and cicatricial contraction of the tubal lumen. However, if the pus increases in amount then a pyosalpinx forms. The mucosa atrophies by pressure or is entirely destroyed by the infectious process, the tube gradually increasing in size. Finally the muscular layer disappears through pressure atrophy.

The course of a primary gonorrhœal tubal infection usually tends to a permanent recovery. The chief dangers in these infections lie in renewed gonorrhœal or mixed infections. Rest in bed in the semiprone posture, the application of icebags or a Leiter coil to the abdomen, soft diet, daily enemata, cleansing hot vaginal douches lead soon to an abatement of the temperature and pain. After 2 weeks, applications of heat as the therapeutic lamp, linseed poultices or Flatau's pelvitherm combined with hot vaginal douches of 20 minutes' duration at a temperature of 105° to 110° F. every morning or evening, usually promote a complete resolution within another 4 weeks. The patient now may be treated for the infection of the urethra, Skene's ducts, Bartholin's glands and the cervix. The method described by Anspach, consisting in the local application of solution of oxychloride of mercury, or the cautery with the nasal

platinum snare as recommended by Dickinson [illegible], Hunner, and Polak (13), and the tamponing of the uterine cavity with 4 per cent formalin solutions as suggested by Findley (14), are those mostly applied in our work. These local applications are repeated until the discharge disappears and stained smears do not show gonococci. The patient is then discharged. Absolute interdiction of coitus and rest during the menstrual periods are ordered. The patient returns to the clinic either before or soon after each subsequent menstrual period for three times when control examinations of the urethra, Skene's ducts, Bartholin's glands, and the cervix are made according to the plan of Norris, namely, three smears are taken from each area on three successive days. If repeated examinations are negative the patient is considered symptomatically cured. It is obvious that the husband must undergo treatment at the same time and at competent hands. That it is a waste of time and energy to carry out this treatment in a prostitute is evident.

An unfavorable prognosis of the course of the disease is associated with a persistence of the original damage, or renewed attacks or other complicating infections. The latter frequently result from intestinal adhesions. Pathogenic germs endogenous to the intestinal tract may by migration enter the diseased pelvic organs. Such an unfavorable course in primary and recurrent gonorrhœal infections and mixed infection may be recognized by a persistence of the fever, the pain, and the bimanual findings in spite of the above described treatment.

If a mixed infection arises the patient shows symptoms and signs of a continued low-grade infection, though oftentimes stormy and grave symptoms and signs may result. With a low-type mixed infection we observe a mild pyrexia of 100° to 101° F., an increase in the pulse rate, continued unabating abdominal pain and gradual loss of weight and strength. Physical examination reveals a rigidity of the muscles of the abdominal wall, tympanitis, and pronounced sensitiveness over the regions affected. Consecutive bimanual palpations performed at weekly intervals elicit a persistence of the infectious induration of the organs and marked sensitiveness of the parts affected.

If the onset of the complicating infection is ushered in with stormy symptoms we must ascribe them to the virulence and number of the organisms and the lessened resistance of the patient. The subjective symptoms are much more aggravated. Temperatures of 102° to 104° F. are the rule, the pulse rate is 110 to 120 or more, and the symptoms of peritoneal irritation, as nausea, vomiting, constipation, and tympany are marked. Bimanual examination reveals a frozen pelvis; softening of the mass may soon occur and a pelvic abscess pointing in the posterior vaginal fornix is early discernible.

If the diseased processes do not respond to expectant treatment but progress, or the tubes have formed pus sacs which resist every known treatment and cause intercurrent attacks of pelvic peritonitis, then surgical intervention offers the only possibility of relief and cure.

Simple salpingectomy is contra-indicated as subsequent inflammations of the stumps from the chronically infected uterus form a continued source of ill health. The results of surgical treatment are much better and more satisfactory if a panhysterectomy is performed. In young women below 35 years of age the latter procedure, however, is almost always accompanied by a stormy surgical menopause and serious metabolic changes. All tissues which elaborate an important secretion must be preserved. Sterility is the lot of almost every woman who has suffered from a bilateral gonorrhœal salpingitis. In considering surgical action in these cases the question of future fecundity may be ignored in determining the best method of surgical treatment. It is not, therefore, the childbearing possibilities that should dominate a decision in favor of a conservative policy, but rather the preservation of the ovarian function (15).

Large collections of pus in the pelvic cavity or large tubal pus sacs lying upon the floor of the recto-uterine pouch are incised and drained through a posterior colpotomy. The incision should be made with the cautery. The rubber T-drain is removed on the fifth post-operative day. Patient may be permitted to be up and about on the eighth day.

Persistence of temperature after opening the pus sac requires a continuation of the semi-prone position. About 65 per cent of patients thus treated are permanently relieved of the subjective symptoms while the rest require additional surgery.

All other cases are subjected to a cœliotomy, which may be safely performed as early as about 3 weeks after the abatement of a recurrent attack or a mixed infection. After the intestines have been pushed up into the upper abdomen and have been protected with gauze pads, the genital organs are gently freed of all adhesions. The ovaries are next carefully inspected. Should they be buried in dense adhesions, cystically degenerated, or the seat of abscessess precluding a future normal function, they must be removed. If one or both of the ovaries can be left behind, it is necessary to preserve their normal blood supply. This is best accomplished by ligating the tubal branches of the ovarian artery separately and by maintaining intact the anastomosis of the utero-ovarian arteries (16). The position of the ovary in the ovarian fossa also should be retained. If the ovaries must be removed I have frequently transplanted ovarian tissues within the abdominal recti muscles. The conservation of ovarian tissue makes it advisable also to attempt retaining the uterus.

The excision of an infected tube implies its total removal including the intramural portion. If both tubes are removed, a wedge-shaped excision of the fundus according to Beuttner (17) is advisable.

The necessity of the total removal of ovarian tissue, of course, demands a panhysterectomy since the cervix is almost always diseased. It is imperative if the cervix is infected or otherwise diseased. The claim that the retention of the cervix furnishes a better vaginal roof I do not recognize.

CONCLUSIONS

1. Gonorrhœal infections of the female genital tract must be actively treated.

2. The diagnosis and prognosis of the course of the infection are solely based upon the repeated microscopic examination of stained smears obtained from the urethra, Skene's ducts, the vulvovaginal glands and the cervical canal, and upon the bimanual palpatory findings considering the course of the tubal infection.

3. The primary gonorrhœal tubal infection is treated conservatively by rest in bed, proper diet, local applications of ice and, later, heat.

4. Infections of the endometrium, the cervix and the vulva are treated by the measures described.

5. Repeated attacks or mixed infections that render the patient a chronic invalid are subjected to surgery.

6. The ovarian tissue should be preserved in patients of 35 years or less.

7. Abscesses pointing into the vaginal fornix are opened and drained through a posterior colpotomy.

8. If ovarian tissue can be left behind, salpingectomy with V-shaped excision of the interstitial portion of the tube is practiced. Otherwise a total hysterectomy is advised.

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SHORT UMBILICAL CORD[1]

By OTTO H. ROHRLACK, M.D., Chicago

THE general impression that a coil or coils of the cord about the fœtus, especially the neck, although quite frequent, is of no special concern, as many cases terminate without much delay or no delay at all in the duration of labor and that many babies are born with little or no asphyxia, has led many physicians to neglect this condition more than the danger to the mother and baby warrants.

An absolute, positive diagnosis is probably not possible, except in a few rare cases when the coil can be palpated *in utero*. In such cases it is of the greatest concern as they are more difficult to manage. After the delivery of the head or breech, when the cord can be felt or seen encircling the neck or coiled about the breech or limb, it is of less concern, as such cases can be managed with ease. A diagnosis can be made in the majority of cases and the attendant then has a better conception as to the conduct of labor, the mother is saved unnecessary suffering and undoubtedly many babies are saved that would otherwise perish. I believe that it is of sufficient importance to the doctor, to the mother, and to the child again to review the subject, placing special emphasis upon the symptoms that will lead to a diagnosis and a better management of the mother and child.

A short umbilical cord may be defined as one which is sufficiently short as to produce clinical manifestations either on the forces of labor, the passages, or the passenger. Much of the discussion of this paper is based upon 100 consecutive labors in which there were 47 cases of shortened cord, shortness being due either to actual shortness or relative shortness, as coils about the neck, shoulders, body, or legs of the fœtus. A case is also included in which a loop about the neck was combined with a true knot.

It is my belief that a shortened cord will always produce symptoms referable to the powers, passages, or the passenger. The mere length of the cord does not determine, alone, whether a cord is actually short. Coils, whether looped once or many times about the neck or body of the fœtus, do not necessarily mean that the cord is shortened. A true knot is of no special concern unless combined with an actual shortness of the cord which causes it to become sufficiently tight to interfere with the circulation of the fœtus.

There were 4 additional cases in which the cord was coiled around the neck that showed no symptoms; also 5 cases, stillbirths, in which the cord was found about the neck. One death occurred 15 days before labor, in all probability due to a shortened cord. In this case there were 4 coils about the neck. In one, in which the cord was found about the neck, death was probably due to a difficult forceps operation in the interest of the mother. There was one, in which the cord was casually found about the neck of the baby. In this case, no heart tones were heard when the patient was first seen in consultation. Labor was terminated by cranioclasis because of a threatened eclampsia and marked disproportion between the pelvis and fœtal head. There were two, in which the heart tones were absent when the patients were first seen in consultation. The labors were terminated on account of exhaustion of the mothers.

Briefly, a number of general considerations relating to the shortness of the cord may be reviewed with advantage. The length of the umbilical cord is normally about 50 to 60 centimeters. It may be as short as 2 centimeters or no cord at all as related in a case reported by Kinne (1), or it may be as long as 120 centimeters and a cord of 108 centimeters has been reported by Dyhrenfurth (2). A normal or abnormal length cord may become relatively shortened when it is coiled about any part of the fœtus, more often the neck, and many coils have been found: three times by Konikow (3) and Kales (4), four times and two times around the arm by Hamill (5), five times, by Maddren (6), and five times with a loop around the chest by

[1] Read, by title, before the Chicago Gynecological Society, April 21, 1922. (For discussion see p. 677.)

Felkin (7), seven times by Fjelstad (8), eight times by Beech (9). Wright (10) reports a cord 6 inches long with a loop around the wrist, and Bartrum (11) three times around each leg. A case is reported in the literature by Edgar (12) in which the cord was coiled nine times around the neck. In our series the cord was found around the neck once in 33 cases, in one of which it was combined with a true knot, twice in four cases, four times in one case, a total of 38 cases in which the cord was coiled about the neck. In 3 cases the cord was looped around a shoulder. In one case it was coiled around each leg and then one coil about both legs. Actually short cords are much more uncommon as compared with relatively short cords. In our series it occurred 5 times, or in 5 per cent in comparison to 42 times or 42 per cent of loopings about the body of the fœtus. The frequency of coils about the neck according to Williams (13), is about 25 to 33 per cent. DeLee (14) found it in fully 20 per cent. In our series, the cord was looped about the neck in 38 cases or 38 per cent. The cord may be coiled about any part of the fœtus in innumerable combinations. It is twisted on itself in a spiral form and the blood vessels are somewhat angularly folded on themselves in a longitudinal direction. This allows the cord to stretch and it will stretch according to Duncan (15), on the average, one-sixth of its length without tearing. He also found that the breaking strain averaged 8½ pounds in one, in one as low as 5½ pounds, the highest 15 pounds. It may be nature's way in excessively long cords to coil them about various parts of the fœtus and thus tend to prevent a prolapse of the same which usually results in death of the fœtus. The ability of the cord to stretch tends to preserve the life of the fœtus and does save the life of the fœtus in all of those cases in which the amount of stretching is sufficient to deliver, at least, the head of the baby without interfering too much with its circulation. The fact, that the cord stretches is important, in an actually or relatively short cord, as it usually gives one sufficient notice of its presence, thereby allowing enough time to institute proper proceedings for the safety of the fœtus and the mother. Cords that have been put on a stretch are apparently less twisted and more thinned out, depending upon the degree of the tension. A cord put on tension will at first stretch and if the tension is increased it will either rupture, as in a case reported by Bacon (16), or pull abnormally on the placenta or the fœtus. The traction on the placenta will cause it to become partially or completely separated, if it is loosely or normally attached or will cause inversion of the uterus if marginally attached as in a case reported by Felkin (7). Traction on the navel of the fœtus may cause a sudden shock, and this may account for the sudden cessation of the heart tones. It also may be one of the reasons of umbilical hernia. During gestation, the cord loops coiled about the fœtus, probably because of the movements of the fœtus in the presence of an unduly long cord. In some cases, it might be conceivable but rather improbable, that during labor, the head passes through the loop.

A relatively short cord causes maternal dystocia and asphyxia in the fœtus more often than an actually short cord. Actually short cords are quite infrequent. The danger to the mother because of the long labor is exhaustion and infection. There is, also, danger from hæmorrhage due to premature separation of the placenta and inertia of the uterus and rarely inversion. Veit (17) gives the following morbidity and mortality in untreated cases of coils about the neck. One in seven babies, the baby was asphyxiated; one in sixty-three, dead, compared with one in twenty-five asphyxiated, and one in ninety-two dead, in other cases. He further states asphyxia is three and one half times twice as frequent in primiparæ as in multiparæ; therefore, in multiparæ the asphyxia is much more rare. Still it is four times as great when the cord is around the neck as when it is not. In our series of 38 cases of shortened cord, 25 were mildly asphyxiated, 4 markedly, and in 9 no asphyxia was present. In our 100 cases, deducting 38 cases of shortened cord, there was only one asphyxia of the baby and this was due to a delayed obstructive labor in a contracted pelvis. Meconium was present 10 times during the course of labor. The danger to the child is greater in primiparæ

than in multiparæ, in exact relation to the length of time of the second stage being longer in primiparæ than in multiparæ. The mere fact that the cord is coiled about the fœtus, in itself, does not mean dystocia or asphyxia, but it does mean danger to the mother and fœtus in a degree exactly proportionate to the amount of actual shortening of the cord. The prognosis improves to a remarkable extent when this occurrence is borne in mind and a diagnosis is made, which can be done in at least 95 per cent of the cases, and in which proper treatment is instituted. Out of all the cases recorded in this series, five deaths resulted. Of these five, in one the cord was casually found and the labor terminated on account of decompensation in the mother; in 3 the heart tones of the fœtus were absent when the patients were seen in consultation, and in one death of the fœtus occurred during gestation, 15 days before labor.

King (18) gives the following points on which a tentative diagnosis can be made: pain at the placental site, arrest of pains especially bearing down, depression at the placental site, desire to sit up in the second stage of labor, bleeding during and after a pain. Brickner (quoted by Kosmak, 19) in addition mentions recession of the head in the interval of pain, small quantities of urine passed in the interval between pains after the establishment of the second stage. Kosmak (20) adds long labor, little progress, heart tones becoming irregular. Beech (9), in the case reported, mentions excessive movements on the part of the fœtus 1 week before term. Depression at the placental site he thinks doubtful. Davis (21) reports a case in which murmur in the cord was present. Rougy in discussing Young's (22) paper "The Cord as a Factor in Infant Mortality" says it should always be expected when the head reaches the perineum and there is no progress, and in addition there is alteration of the heart tones of the fœtus. Rachel (23) (quoting Caseaux) mentions insufficient flexion, overrotation of the occiput. Elmore (24) says it prevents engagement, encourages antepartum detachment of the placenta and inversion of the uterus. Bissell (25) thinks it causes occiput posterior positions and interferes with flexion of the head in the first stage of labor. Harvey (26) mentions no descent of the head. Schatz (27) reports listening with the ear to the heart tones of the fœtus. The heart beat ten to twelve normal beats, then sank to one half of that rate. When pressure of the ear was removed, the normal frequency returned at once, only, after six or seven beats. He then found that pressure over the cord which was around the neck gave the same auscultory results. Humphreys (28) says the mother cries out in the second stage the same as in the first and that there are no bearing-down efforts.

In analyzing all of these symptoms, it is seen, that they depend upon the degree of shortness and location of the cord, whether actually short or coiled about the fœtus, mostly the neck, and the time of the occurrence, whether before labor, in the first or second stage depend upon the time when the cord becomes taut, and then the symptoms will begin to make themselves manifest. The symptoms appear most often, when the head is low down on the perineum and become less frequent, the higher the head is situated in the passages and least frequent, when in the uterus, before rupture of the membranes, during labor, or even at the latter end of pregnancy. The reason for this is that the frequency of very short cords is less than the moderately shortened cord. Many of the symptoms recorded in the literature apply only to exceedingly short cords, and although pain at the placental site, depression at the placental site, inversion of the uterus, funicular souffle, never were observed in our series, it can be seen that under the proper conditions one or more of these symptoms might be present. In one case a funicular souffle was heard during pregnancy and labor, where no shortened cord was found. In our series, a diagnosis was made, based most often upon the behavior of the heart tones of the fœtus and the character of the labor. In the absence of disproportion, the marked variation in the heart tones of the fœtus was observed thirteen times when the head was *in excavatio*, twenty-four times in *infra aditu* and once when *in aditu*. In the further discussion of the symptoms in

detail, it is found that they bear on the three factors of labor, the powers or forces, the passages, and passenger. The force of labor, the uterine contraction, in the first stage are many times ineffectual on account of the interference of the normal mechanism of labor. The membranes may rupture early because they are more or less unprotected by the presenting part, that is, if the cord is sufficiently short to interfere with descent; for the same reason the cervical dilatation is slow. In the second stage of labor, at the time when the cord becomes taut, the contractions of the uterus and abdominal muscles become ineffectual, there is no bearing down or bearing down is arrested; in fact, the patient frequently cries out, the same as in the first stage. This action of the uterus and the mother is, I believe, of considerable diagnostic importance. The passages beside the slow dilatation of the parturient canal, if the cord is sufficiently short, the attachment of the placenta may be interfered with, resulting in partial or complete separation of the same, which shows itself in bleeding during and after each contraction, or after the delivery of the child. The traction on the placenta may be the cause of the woman desiring to sit up. This was observed in only two women in our series. The effect upon the fœtus is due to traction or compression of the cord interfering with its circulation, and this is the most important effect, causing the heart tones to become primarily slowed or absent, then increasing in frequency to normal or above, and with the next contraction, perhaps, complete cessation and the gradual returning of the same during the interval of these contractions. This results in asphyxia of the fœtus, and if severe enough meconium is passed. If the asphyxia is continued long enough death results. If the interference of the circulation is sudden and this is rare, the movements of the fœtus become violent, the patient speaks of these movements, and they may be seen by the physician. During pregnancy, the woman may speak of the unusual activity of the fœtus for a varied period, and this period may be followed by absence of motion. The woman is examined and no movements or heart tones can be detected, and the death of the fœtus is found. [illegible] symptoms was diagnosed as being due probably to a shortened cord and 15 days later, when the baby was born, the cord was found coiled four times about the neck.

In our series a shortened cord, actual or relative, caused partial separation of the placenta during labor 7 times (tears could be eliminated) resulting in hæmorrhage, during and between pains. This was combined with a temporary absence or slowness of the heart tones, and the absence of characteristic second stage pains. There was also excessive bleeding immediately after labor in 10 cases, probably, most often due to a partial separation of the placenta. The shortened cord interferes with presentation, thus it may be a cause of transverse and probably breech presentation, and, in one of our cases, there was a breech presentation which, by external version, was changed to a head presentation, 2 weeks before term, and at the termination of labor the cord was found about the neck of the baby. It may also be a cause of face presentation as found in one of the stillbirths, deflexion, and parietal bone presentation. The latter was found in 2 cases, over-rotation of the head in one case, interference with the descent of the head in over one-half of our cases, and recession of the head between pains, with a small variability in the degree of descent with contraction in approximately one-third. The engagement of the head in a primipara may be interfered with in the last stage of pregnancy and certainly is suspicious of a shortened cord when it occurs with head presentation, absence of hydramnios, disproportion between the head and the pelvis, twins, and congenital weakness of the abdominal wall. Two such cases appear in this series. A diagnosis was made one week before labor. At labor, in one the cord was found around the neck of the baby, and in the other around the legs. It probably causes a greater frequency in posterior positions of the occiput. In this series there were twenty-one posterior positions, thirteen occipitolævoposterior, and eight occipitorectoposterior.

The treatment is comparatively easy and becomes progressively more difficult, depending upon the location of the presenting part,

usually the head, and the condition of the passages, easiest when the head is on the perineum and more difficult when the head is not engaged. When the head is completely engaged or on the perineum, dilatation complete, heart tones of the baby giving the indication, the forceps are applied, and the fœtus is delivered after a preliminary dilatation of the vagina and perineum digitally, manually or with incision if necessary. If there is interference with the descent of the head, membrances intact, no disproportion and the cervix not completely dilated, the membranes are artificially ruptured, labor is allowed to progress until interference is indicated by the heart tones of the fœtus, either forceps are applied preferably or version after a preliminary dilatation of the passages and the fœtus extracted. If the head is floating, an attempt might be made to slip the cord from the body of the child, usually the neck, or if absolutely short it could be cut *in utero* followed by a version and rapid delivery. If version appears easier than high forceps, it may be done. Posture and pressure upon the uterus is of no special advantage. This probably lengthens the cord in this condition and should be employed only when a slight additional lengthening is all that is necessary to deliver the head. It seems to me, that forceps can be applied with less danger to the child and no more danger to the mother if this condition is present. However, if the head is showing, it may be of advantage to allow the woman to assume a semi-sitting posture. Then the force of the contractions aided by pressure upon the uterus, with a preliminary episiotomy, if the outlet unduly retards the progress of the fœtus will accomplish delivery. When the head is delivered, it may be necessary in order to deliver the body of the baby to free the cord from the neck either by slipping it over the shoulders or head or by cutting it when markedly shortened. This probably would prevent excessive bleeding in the third stage of labor, in some cases, where the placenta has been partially separated by too much traction on the cord in the attempt to slip it over the head. To save the fœtus in our series, forceps were applied 17 times, expression 4 times, expression and episiotomy 3 times, manual rotation 4 times, incision of the cervix once, Voorhees bag 2 times.

CONCLUSIONS

1. Relatively short cords are frequently found.

2. A cord coiled about the neck of the baby rarely produces symptoms unless it becomes relatively shortened due to such coiling.

3. A comparatively low position of the head is frequently found in short cord cases.

4. The points upon which a diagnosis can be made are variability in the heart tones of the fœtus combined with a variation in the forces of labor, presentation, position, and station of the passenger, and the slow dilatation of the passages.

5. Prognosis improves with diagnosis and treatment.

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DEPARTMENT OF TECHNIQUE

TREATMENT OF UNDESCENDED TESTICLE

By JOHN R. CAULK, M.D., F.A.C.S., St. Lo[illegible]

CONGENITAL lesions of the external genitals, while not particularly frequent in their occurrence, have been exceedingly difficult of correction and have stimulated an enormous amount of investigative work, with its resulting literature, directed toward the correction of these defects.

In spite of numerous attempts at correction, congenital lesions of the penis are still far from having a proper solution. On the contrary, those of the testicle have responded with far more gratifying results, and offer, indeed, a bright field for plastic surgery.

Let us classify congenital defects of the testicle into those of development, nutrition, and migration.

The anomalies of development, such as polyorchism, anorchism, and synorchism will not be considered, because of their extreme rarity, nor will the anomalies of nutrition, such as hypertrophy and atrophy be discussed, except as they apply to the problem, namely the most important defects involving the testicle—those of migration.

Anomalies of migration may be divided into retention, ectopia, inversion, and retroversion, depending upon whether the testicle is undescended or descended, the former being decidedly more frequent.

A testicle may be arrested at some point along its normal course, and it is then called an undescended testicle or cryptorchism. Should it be pulled in an aberrant position, it is commonly spoken of as an ectopic testicle. This latter anomaly, which is supposed to be due to faulty development and attachments of the gubernaculum testis, is exceedingly rare, so let us devote our attention to a discussion of the more important anomaly—the undescended testicle.

The cause of the testicular retention has not as yet been definitely determined. There are various theories, but, up to the present time, no satisfactory one prevails.

Eccles classifies the causes into those due to disturbances of the mesorchium, those associated with changes in the component parts in the testicle, to atypical development of the route along which the testicle proceeds and to faulty attachments of the gubernaculum.

The mesorchium may be too long, allowing the testicle to have such freedom as to prevent its entering into the inguinal canal, or there may be adhesions between it and the peritoneum, prohibiting its engagement. With respect to the conditions of the testicular attachments, the spermatic vessels may be shortened, the vas deferens may be of insufficient length. The testicle and epididymis may be too large to engage in the internal ring.

The gubernaculum, which is supposed by some to pull the testicle down to its normal position by traction, may be either absent or deficient in its lower attachment, its muscle fibers may be either wanting or materially decreased.

The inguinal canal may be small and ill developed. There have been incidents of a small superficial abdominal ring. Some authors believe that the lack of scrotal development has played its part. In observing these cases, one is particularly impressed with the importance of the fascial coverings of the cord, as the potent factor in the faulty descent.

The fascia, as it emanates from the internal ring is usually the most pronounced barrier to the lengthening of the cord. It can be frequently observed at operation that the mere nicking of these strands will allow the testicle to be pulled into the scrotum. All these factors may have an influence in the production of this anomaly, yet there is still indecision.

A large number of infants at birth have undescended testicles. Wrisburg's statistics show 30 per cent. The majority of these descend to the normal position within a few days or weeks of postnatal life. A certain percentage gradually come down within the first year, so that the physician need not concern himself with this anomaly in the early period of the infant's life.

Read before the St. Lo[illegible] Medical Society, [illegible]

But, if the condition persists for one year, the chances of normal descent are exceedingly meager.

There are rare instances where the testicle has descended after 14 years of age, or even in the twenties following a sudden strain. "Ambrose Paré cites an amusing story of Marie Germaine, who, jumping into the ditch in chasing her pigs, returned in tears to the house of her mother and exclaimed that her entrails were coming out of her belly." Whereby her true sex was recognized and she became a man.

Coley, in the Hospital for the Ruptured and Crippled, found 3 per cent of undescended testicles in boys under 14 years of age, 2.2 per cent between 14 and 21, and only one of 1 per cent after 21. Marshall found 11 cases in 10,800 recruits. And Hempel said, that, of 7,000,000 Austrian recruits, 0.2 per cent were affected. In other words, we may expect this anomaly in two cases out of every thousand, a condition of sufficient frequency to demand our careful consideration. For this reason, I have made analytic study of 55 cases, which occurred in our clinic and in private practice. This condition may be unilateral or bilateral. In infants, it is usually bilateral. Within the first few months, 60 per cent are bilateral. In adult life it is more commonly unilateral. Of the 77 cases reported by Odiorne and Simmons, 15 were bilateral, 39 on the right and 23 on the left. In our 55 cases, 42 were unilateral, 21 on the right and 21 on the left, and 13 bilateral.

I was particularly impressed with the frequency of this anomaly while serving on the draft board, and on inquiring from these individuals why they had kept their retained testicle, most of them stated they had been advised against surgery and were told there was very little chance of bringing the testicle down, that usually the organ had to be removed. A great many of them were wearing trusses for the correction of their hernia, but, of course, for the destruction of the testicle.

Owing to the unsatisfactory result of former days in the handling of this unfortunate condition, pediatricians, particularly, have been prone to advise against any surgical correction. But since there have been such pleasing results through surgery in recent years, this discouraged attitude on the part of the pediatricians and clinicians should be changed, and we hope for their co-operation in this phase of surgery in order to protect such a number of individuals from the consequences which may ensue to the testicle from its malposition.

What are the reasons that would prompt us in advising the transplantation of the testicle?

In the first place, practically every undescended testicle is associated with actual or potential hernia, and this, of itself, should demand a surgical correction. Moschcowitz stated that 100 per cent have hernia. Coley, in 415 cases, found hernia in every instance but 3. In our 35 operative cases, 32 had definite hernias. Other observers quote lower figures. Odiorne and Simmons 57 per cent. On account of the hernia, many of these individuals have worn trusses. This, of course, should be most positively condemned, since by its pressure effects it is almost certain to insure disaster to the testicle. Some authors claim that strangulated hernia is more common in the presence of an undescended testicle.

Second, pain due to the pressure of the surrounding muscles upon the gland is often of sufficient importance to warrant the operation. Repeated injuries from the exposed position of a testicle in the region of the external ring is also troublesome, and should demand correction since such repeated trauma with its resultant inflammation predisposes to atrophy.

An organ so important to the human economy should, if possible, be protected from atrophy. And since the undescended testicle is so prone to this condition, our efforts should be exerted toward bringing it in its natural place.

It is a well-established fact that the undescended testicle suffers pronounced change in function and histology. The spermatogenic function weakens and usually disappears. Eccles and Uffreduzzi claim that but 10 per cent of the spermatogenic cells remain in the adult. Bland Sutton claims that after puberty, practically all the spermatogenic cells are lost. Curling believes so thoroughly that sterility accompanies undescended testicle that he states he is compelled to doubt the parentage of such children.

There are, however, instances of fertility in double cryptorchids. For instance, Beigel found spermatogenic cells in a man 22 years old, with bilateral inguinal retention. Odiorne and Simmons published microphotographs of an undescended testicle from a man 30 years of age. In some of the tubules, there was seen active spermatogenesis. Other observers have found actively motile spermatozoa in adults from 20 to 24 years of age afflicted with bilateral undescended testicle. In two of my cases, I found slightly motile spermatozoa from the head of the epididymis. This fertility is usually short-lived, seldom over 5 to 10 years after puberty. There are instances of persistent fertility, such as the case of Milnar Smith, who reports a double cryptorchid, the father of 5 children.

It, therefore, seems reasonable to attempt to protect a testicle from such pathological changes and give it every chance of normal growth, and while many transplanted testicles may not develop spermatogenic function, I believe a fair percentage will, if correctly placed at the proper time.

Another important element which bears on this problem, is the psychic effect which the undescended testicle has on a certain number of individuals. Many of them are chagrined at their condition and become morose, neurasthenic, and melancholy. And there are instances in which the inserting of celluloid balls has had a pleasant effect upon the mental attitude of the individual.

The interstitial cells of the testicle, which have been definitely proved to have to do with the secondary sexual characteristics, through an internal secretion, are not so easily affected, as these spermatogenic cells. Indeed, many cases show marked increase in the number of these cells. Later on, however, in many instances, they are liable to atrophy and all that may remain of the testicle would be a nodule of fibrous tissue. Should this be bilateral, it is easy to see the effects on the general economy. Lespinasse says a normal testicle taken away from its scrotal position and placed in the abdomen will atrophy. There are instances reported, where individuals with double cryptorchism had one of the testicles transplanted before puberty, the other not, to show, later, a complete development of the transplanted testicle and a complete atrophy of the testicle which was allowed to come down later on of its own accord. This would all seem to indicate, that, for the preservation of this important gland, it should be put into its normal position before the age of puberty.

Hydrocele, gangrene, abscess, and peritonitis are rarer conditions. Four of our cases had hydrocele. Tortion and strangulation of the cord occur almost entirely in the undescended organ. The susceptibility of the undescended testicle to tumor formation has been creative of considerable debate and has been handed to us, really as a tradition. Eccles was one of the first to dispute it, but most authors are of the belief that such testicles are much more prone to neoplasms. Cunningham collected 452 cases of tumors of the testicle. Four hundred and twelve occurred in testicles normally placed and 40 developed in the undescended organ, but we must remember there are 500 times as many normally placed testicles as undescended ones; therefore, this proportion seems to express a decided inclination of the undescended testicle to form tumor.

You should, therefore, be convinced that there is abundant evidence to corroborate the view which is so definitely fixed in my mind – that the undescended testicle should be brought into its normal resting place and at a time early enough to protect it from the complications mentioned above, provided there is a method of execution which will not execute the testicle.

In our series, there were [illegible] and 2 surgical cases. In the medical cases, there were 17 children and 13 adults. Many of these children were inoperable on account of other acute conditions, such as pneumonia, pleurisy, endocarditis, etc. Some had severe congenital abnormalities, such as hypospadias, exstrophy, and the like, although as a general rule, other congenital defects are not so frequent in the adult in association with undescended testicle. Eight, or 14 per cent of our series had these defects.

A number of the operable patients were unfortunately advised against operation. Of the cases operated upon, there were 19 children with an average age of 6 years, and 18 adults. The descended testicle was cited as normal in 35 instances, larger than normal in 2, and smaller in none.

The undescended testicle was described as smaller than normal in 18, normal in 9, and in 11 cases, there was no note.

The testicle may be arrested as has been previously stated anywhere along its path. The most frequent location is within the canal. In our series, there were 14 near the external ring, 2 well within the canal, 7 at the internal ring, 3 intra-abdominal, and 1 femoral or ectopic.

TREATMENT

In early years, that is up to 6 years, the testicle may be encouraged by gentle massage and pressure from above and behind as was advocated years ago by Lengenbeck. Should it not descend either spontaneously or through this encouragement, surgery should be done. The time of election for the operation is certainly before puberty. Most authors believe in not operating on young children, certainly not before 3, on account of inability to keep them dry. Most authors agree that the best age is between 6 and 12.

The treatment of the undescended testicle may be classified as manipulative and surgical. The application of the forked truss, advised early in the history of treatment of this malady, was very ineffective both in bringing down the testicle and in the retention of the hernia. Various traction operations have been employed

The Landz operation was one of the first. By this method, sutures were placed through the testicle and scrotum and fastened to either a cage or the thigh and continuous traction was exerted on the cord. The operation had few successes and many recurrences.

Starr advised a traction splint, which was fixed to the pubic bone and scrotum and the testicle pulled by this method.

The Schueller's operation was designed because of the belief that the open tunica vaginalis was the cause of the abnormal descent, and consisted in dividing the tunic at the internal ring, forming a new tunic by its lower part and anchoring the testicle to the scrotum by suture or to its fellow on the opposite side.

The Keetley-Torek method consisted in liberating the testicle, correcting the hernia, fixing the testicle to the skin flap on the thigh, with the idea of exerting traction on the cord and at a later operation the testis was liberated from the thigh and placed in the scrotum. The operation was attended with very uncomfortable convalescence, both from pain and liability to infection and its results were inferior to the magnitude of the operation.

All of these traction operations missed the point in that they were unable to correct the cause of non-descent and immediately upon cessation of traction, there was a tendency for the testicle to resume its original place.

Orchidectomy has been done a great deal for this malady and in most instances without any excuse. The objections to it are so apparent that they need but little mention. The only excuse for orchidectomy would be a tumor and possibly the inability to bring the testicle into the scrotum.

In our 35 surgical cases, this operation has been done 5 times. I have never been compelled to castrate and have done the largest portion of these operations, yet on the surgical service, where many of these operations have been done by assistant residents, internes, and uninterested general surgeons, in fact there have been 9 different operators, 23 per cent have been castrated and I dare say in general practice, the percentage is higher than this, which, in itself, should create marked hesitancy on the part of the pediatrician to subject children under his care to surgery. And certainly the promiscuous removal of a testicle is most heartily to be condemned and demonstrates conclusively that this operation should be done only by one who is interested and experienced in this problem.

Replacements of the testicle within the abdomen and closure of the canal formerly had a certain number of adherents and just recently at the Southern Medical Association, a paper was read advocating this procedure. The author stated that in a fair percentage of cases, such a method became necessary. There is absolutely no advantage to this operation. It cures the hernias, but the testicle is exposed to all the dangers which might befall an undescended organ and is placed in a more dangerous locality in case of trouble. There is very little excuse for this operation.

In the correction of an undescended testicle, there are two factors, which we have to bear in mind: first the correction of the hernia, second, the transplantation of the testicle into the scrotum without tension, and without injuring the important structures of the cord, which have to do with its nutrition and its healthful support.

It remained for Bevan, of Chicago, in 1898, to propose an operation which, in many instances, fulfilled the above necessities. This operation is more or less familiar to you all, and consists in the liberation of the hernial sac from the cord, closure of the sac, lengthening of the cord by incision of its coverings, and, if this does not suffice, the ligation of one or the other of the vascular supplies, usually the spermatic.

Bevan believes that the vessels of the vas are sufficient to carry on the nutrition of the testicle. Moschcowitz supports this view, as do also Griffiths and Hill. On the other hand, Mixter showed that the artery of the vas was entirely insufficient to support the life of the testicle and that 92 per cent show atrophy, following ligation of the spermatic vessels. Whereas, only 5 per cent show any atrophy if these vessels, were not disturbed. This has recently been accepted by most authors; therefore, it is essential to preserve the integrity of the important structures of the cord in the correction of this defect.

Keyes in 1917, in reporting 33 cases with 88 per cent perfect results, used a modified Bevan operation and laid great stress on the preservation of the vessel and attached supreme importance to the removal of the fascial investments.

Since 1916, I have been particularly impressed that the fasciæ of the cord are the chief factors in its shortening and have in many instances been able to bring the testicle from the middle of the canal to the bottom of the scrotum by simply nicking the fasciæ at the internal ring, holding the testicle upward and swinging it around a circle, with the center at the internal ring. Nicking the cord on the different parts of its circumference, will often give enough lengthening to suffice. These various modifications of the Bevan operation will generally enable the operator to get the

testicle down without cutting the vessel or nerves of the cord. The vas is usually not shortened; in some instances, it is remarkably lengthened, going downward to the scrotum and back to the testicle. Should it be shortened, it can be freed from its attachments by making traction on the outside, and freeing it with the finger beneath the abdominal wall.

In 1911, Davison, of Chicago, proposed a new method of transplantation. In this operation the posterior wall of the canal is treated much as in the Fowler operation. After ligating the deep epigastric vessels, the posterior wall of the canal is opened, thereby destroying the internal ring. After the vessels and vas are freed, the testicle is put in its bed in the scrotum. The posterior wall of the canal is closed and the cord brought out through the lower angle of the incision.

In 1915, Wolfer modified the Davison operation. His technique consisted in freeing the cord, and bringing it out beneath the deep epigastrics, without cutting them. The rest of the operation was like the Davison operation. I have had to use the Davison modification once.

The one thing that must be understood in operating upon the undescended testicle is that "Patience is the greatest virtue." One can not expect to perform the operation quickly. Often when things look gloomy for a satisfactory transplant, if the surgeon continues in incising and stripping away the intimate fascial investments of the cord, he will be delightfully surprised at his accomplishment.

The results of the modified Bevan operation have been exceedingly gratifying.

Usually it is unnecessary to suture the lower pole of the testicle to the scrotum. It has been my custom, however, to do it simply as a method of steadying the position of the testicle within the scrotum and not for traction.

In certain instances, where the cord, after the fasciæ have been almost completely stripped, shows slight tension after the testicle is placed in the scrotum I have found it best to place two or three traction sutures along the cord in island of fasciæ, uniting the cord at these points to the canal in order that retraction will be obviated. I, also, occasionally put a suture around the neck of the scrotum. This latter, however, is seldom essential.

Bevan reports 41 consecutive [illegible] cases with results so satisfactory as to do credit to any surgical operation.

In my personal cases, I have had excellent results in practically every one. There were 17 cases done in our clinic on which the vessels were cut. There were 13 cases in which no vessels were cut, 9 of these latter were my personal ones. The remaining 4 were done by other operators. You will note the preponderance of the cut vessels in bringing down the testicle done by those who evidently did not take sufficient pains.

The testicle was brought down to the bottom of the scrotum 25 times, not quite to the bottom in 5 cases, not mentioned in 1. Of the 5 that were not brought completely down, one is down at present, the other is lower, another has retracted to the ring. Of my personal cases, there has been but one slight retraction.

Glancing at our statistics, though our cases are small in number, we see that when one is careful and painstaking and appreciates the value of a living testicle, his efforts are compensated by very satisfactory results. Whereas, if there is neither patience nor interest, about 25 per cent are castrated and a large percentage of the rest suffer atrophy for ligation of the vessels.

In closing, I believe that the plastic operation for undescended testicle done according to Bevan's technique with certain modifications designed particularly at lengthening the cord without cutting the vessels is an extemely satisfactory operation, attended with a high percentage of cures and a negligible mortality.

CHOICE OF OPERATION FOR DUODENAL ULCER[1]

By LEGRAND GUERRY, M.D., F.A.C.S., Columbia, South Carolina

To the best of my knowledge and belief we are curing approximately 75 per cent of the cases of duodenal ulcers by simple gastro-enterostomy. In some clinics the proportion of cures may be higher and in some lower than 75 per cent, but the general average, I believe, is fairly represented by the above figure. By a cured case, we mean a case given complete symptomatic relief by operation. To my thinking this proportion of uncured cases, 25 per cent of the total, is much too high, for one must remember that 25 per cent of uncured cases of duodenal ulcer in the aggregate represents a very great volume of unrelieved patients; consequently, any effort made and any reason given by which the porportion of cured patients will be increased, should be carefully considered. In our opinion, one of the things, at least, responsible, is the fact that many of us have formularized our thinking on the question of duodenal ulcer; by which I mean to say we have come to look on duodenal ulcer and gastro-enterostomy as convertible terms. You see what I mean at once: a patient has duodenal ulcer, therefore we must do gastro-enterostomy. This is bad logic and poorer surgery. It would be unfair to make this statement in a harshly critical way, for so many of us, we believe, have fallen down just here, myself included. The operation of gastro-enterostomy for this condition has been placed in a position of such prominence, and deservedly so, by so many men, that we have come to believe that this is the best way to relieve all cases of duodenal ulcer.

Time sufficient has elapsed now, however, and we are beginning to get the end-results. It is becoming increasingly clear that here, as elsewhere, there is a definite place for the proper choice of methods. The whole object of this paper revolves around this point, namely: a judicious selection of method to meet the indications in each individual case.

Two cases just here will serve as a concrete illustration of what we are trying to get at. Two years ago, I saw a surgeon, one of the leading men in our country, operate on two cases for duodenal ulcer, during one morning's clinic. On both of these patients he himself had operated about 2 years before for duodenal ulcer, doing a simple gastro-enterostomy; both patients had been given temporary relief and after the above length of time had recurrence of symptoms; hence the second operation. When the first was operated on, the ulcer was found clear and definite on the anterior surface of the duodenal cap. The ulcer apparently was unaffected in any way by the previous operation and the gastro-enterostomy opening was completely closed. The ulcer was then excised and a straight closure of the duodenum made; the gastro-enterostomy opening was taken down. In the second case, the ulcer was practically identical with that in the first, and was managed in the same way. The gastro-enterostomy stoma, however, in the second case was perfectly patent and normal; this opening was also taken down. The work was done by a man who puts any criticism of technical performance completely aside, yet I am convinced that excision of the ulcers in the first instance would have been better surgery and the surgeon in charge made this point immediately. There are among my own cases two that are practically identical. Additional illustrations from other sources would serve no useful purpose; these are ample to prove that there is increasing room for a proper selection of method to meet the indications in each individual case.

The lesson to be learned from the above cases seems to me perfectly clear and definite; namely, that there are cases of duodenal ulcer in which gastro-enterostomy alone does not suffice.

Balfour, in a recent paper, has touched upon a point which we believe has been little thought of and yet must surely be the fundamental principle in the treatment of all ulcers, duodenal and gastric as well; namely, mechanical and physiological rest to the inflamed part.

John Hilton, in his truly great book on *Rest and Pain*, lays bare the principle that must govern successful treatment of all ulcers. Hilton says, in speaking of the process of repair of wounds in primitive man: "Pain was made the prime agent. Under injury, pain suggested the necessity of, and, indeed, compelled him to seek for, rest. Every deviation from this necessary state of rest brought with it, through pain, the admonition that he was straying from the condition essential to his restoration. He must have observed with astonishment the breaking asunder of the newly formed tissue or the steady development into normal structure, which occurred in exact accordance with the disturbance or rest to the parts, which the sense of pain had enabled him to regulate so accurately, and to employ so beneficially for his own personal

[1] Read before the Southern Surgical Association, Pinehurst, North Carolina, December 11—13, 1921

relief and comfort. . . . What I have here endeavored to inculcate is that growth and repair bear an exact relation to due physiological rest, local and general."

This principle applies fundamentally to the cure of all ulcers. The method which comprehends this fact will endure; the one which does not, cannot endure. For, in a very real sense, there is no difference between ulcer of the leg, ulcer of the rectum, or ulcer of the duodenum. The same principle underlies the process of growth and repair in both animal and vegetable kingdom.

Just as sleep is man's greatest earthly [illegible] bringing physiological rest to his tired body and brain, so mechanical and physiological rest to the local ulcer area is the one great essential of repair. Let us remember also, that just as the body chemistry is changed during the process of physiological rest to normal alkalinity, so the chemistry of the local ulcer condition will be likewise changed by mechanical and physiological rest applied to the local area. Any method of operating that applies this principle truly will be successful. With this principle carried out, we will gain three primary points: (1) mechanical rest; (2) physiological rest; (3) altered chemistry, which, in turn, means a healed ulcer.

With this brief statement of the general principles that should underlie the proper treatment of duodenal ulcer, at least as we understand them, we are ready to consider very briefly the choice of methods when dealing in a surgical way with ulcers in this location.

METHOD I

It is very evident from statistics from many sources, that gastro-enterostomy will relieve permanently 75 per cent of all cases operated on. Gastro-enterostomy is an excellent method, it is simple to perform, has an extensive field of application, and the results are good. It is a method to be carefully considered (1) in stenosis of the pylorus; (2) in ulcers that encroach on the lumen of the pylorus; (3) in a highly placed and inaccessible stomach; (4) in perforating duodenal ulcer where we wish to add gastro-enterostomy to simple closure, although pyloroplasty can be used in the presence of perforating ulcer; (5) when the duodenum cannot, for one reason or another, be mobilized. In all ulcers where bleeding is a complication, direct attack must be made on the ulcer itself.

METHOD II

I must confess to a strong liking for the Finney pyloroplasty, and in my personal work this is the operation of choice, whenever the duodenum can be mobilized. This method [illegible] purely, because it seems to meet, more nearly than any other, the principles mentioned above.

In a paper by Finney and Friedenwald, published in SURGERY, GYNECOLOGY AND OBSTETRICS, March, 1914, in which the authors review 100 cases of pyloroplasty, we find 5 deaths immediately following operation; 13 cases that were not heard from. Of the 82 cases definitely tabulated, there were perfectly satisfactory end-results in [illegible]. This is getting the per[illegible] of [illegible] ought to be.

According to Finney, the only contra-indication of pyloroplasty is inability to mobilize the duodenum.

When adhesions are very dense and there is thickening and infiltration about the pylorus, mobilization of the duodenum is quite difficult and should not be attempted. To me, at least, the dividing line between gastro-enterostomy and pyloroplasty rests in large part on this question of mobilization of the duodenum.

To quote from Finney's article in SURGERY, GYNECOLOGY AND OBSTETRICS: "The special advantages of this operative procedure lie in its affording the opportunity to excise all ulcers in the anterior walls of the stomach or duodenum after direct inspection of the part affected; also the application of treatment to ulcers situated in the posterior walls. It does not greatly disturb the normal relation between the stomach and intestines as is the case in other operations."

Our knowledge of the physiology and mechanics of what happens to the food in the process of preparation of digestion that goes on in the stomach, shows conclusively, we think, that when food first enters the stomach it undergoes a very thorough process of liquefaction and chymification. During the above process it is thoroughly mixed with gastric juice. This is nature's preparation of the food for what happens to it in the duodenum. When the food is thoroughly prepared the pylorus relaxes and the food enters into the duodenum. We know that the duodenum has a churning motion which thoroughly mixes the [illegible] with bile and pancreatic juice. What we have eaten is then prepared to pass farther on into the [illegible].

We can readily understand that when a patient has been the subject of a gastro-enterostomy the food is dumped immediately into the last portion of the duodenum without the natural process of preparation. We believe this fact explains why it is that quite a number of patients upon whom a gastro-enterostomy has been performed will get

immediate help from the operation, but after the lapse of a certain length of time, begin to have vomiting, diarrhœa, and many other symptoms of digestive disturbance.

The intestine at this point is wholly unsuited to meet this unusual and unnatural physiological demand. As has been stated, the fact that so many of these cases are cured proves a wonderful adaptability of nature.

Stenosis of the pylorus is the crowning indication for a gastro-enterostomy.

If it is true that the stomach possesses the segmental activity, then it would appear that an operation of this type must interfere with such activity to a greater or less degree.

This is a clear, distinct, and great advantage of pyloroplasty over gastro-enterostomy.

METHOD III

There is an excellent method devised by Balfour which is really duodenoduodenostomy; this method finds its chief application in rather a large duodenum which is freely movable. It is a simpler operation than pyloroplasty and is excellent in cases suitable for its use.

METHOD IV

We have had occasion to do the Horsley operation three times and with excellent results in each case. We believe that pyloroplasty, as time goes on, will have a broader field of usefulness and will be more generally adopted.

Quite a few of the bad results following operations for duodenal and gastric ulcers are due to the fact that sufficient attention is not paid to a strict dietetic régime. Some will think this is a small point, but in my opinion, it is most important. A carefully graded and regulated diet is most necessary. Balfour calls attention to the great importance of focal infections in the etiology of this disease and points out that a systematic search for various foci of infection must be added to the general surgical plan.

In our humble opinion, that operation will hold first place ultimately which, when it has been completed, obeys most closely the following points:

1. When it produces mechanical rest;
2. When it produces physiological rest;
3. When it produces an altered chemistry, which is dependent on the first two points!
4. When the position and motility of the stomach are the least interfered with.

Finally, let us remember this: we are after increasing the number of complete symptomatic cures from 75 per cent to 95 per cent or even more if possible. To carry out the above principle successfully there is room, and lots of it, for the exercise of the very highest degree of surgical judgment and discrimination in the proper selection of method to suit the particular case in hand. It is not primarily a question of the mechanical performance of an operation, but a proper understanding of general principles and the surgical philosophy which rests thereon.

A MUSCLE CLAMP TO BE USED IN THYROIDECTOMIES

By E. V. MASTIN, M.D., Rochester, Minnesota
Fellow in Surgery, The Mayo Foundation

THIS muscle clamp is particularly serviceable in cases in which the sternohyoid and sternothyroid muscles are cut in the course of thyroidectomy. It has three important features: it does not crush or devitalize the muscle, it does not slip, and the downward curve of the handles prevents them from being in the way of the operator. The weight of the clamp

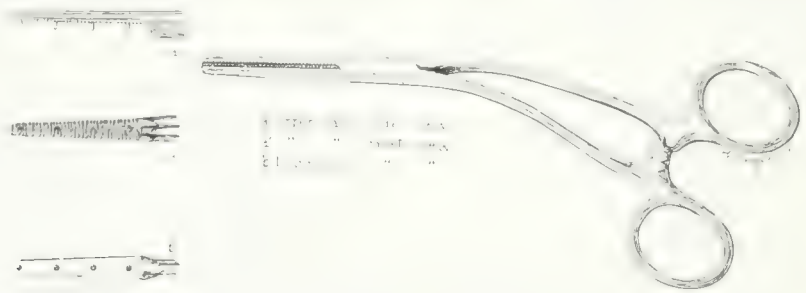

Fig. 1. Details of the clamp.

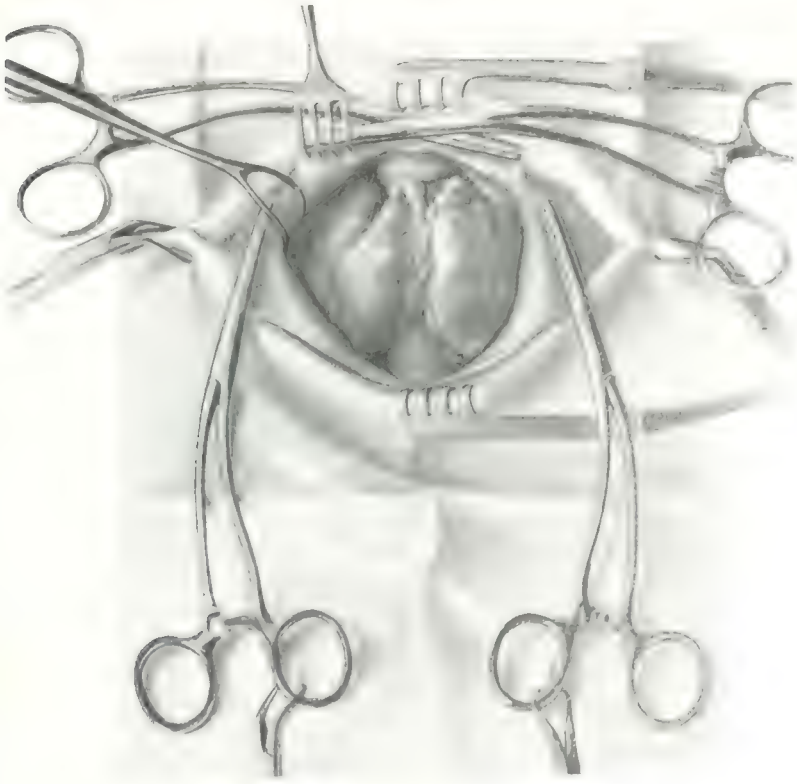

Fig. Clamp in position.

is about that of a 6.5-inch Ochsner clamp, and is constructed so there is $\frac{1}{16}$ inch separation between the jaws when they are closed. The pressure is sufficient to prevent bleeding from the cut edges, yet the muscle is not crushed. The upper jaw is corrugated and contains four pins $\frac{1}{4}$ inch long, which prevent the muscle from slipping. The lower jaw is smooth, and thus is easily slipped under the muscle; it contains four holes $\frac{1}{16}$ inch deep, which admit the four pins in the upper jaw.

A NEW BONE SAW

By MITCHELL LANGWORTHY, M.D., Spokane, Washington

It may not have occurred to surgeons who have done a relatively small amount of bone work that there is any need for a new bone saw. A casual reading of many of the articles written on this branch of surgery, and a perusal of their drawings and diagrams, have somewhat dazzled the medical profession. The remarkable feats of reconstruction described have unconsciously led the reader to believe that bone surgery is a perfected art. Very little of the grief associated with this kind of work is revealed in the literature. The uncertainty of some of this work is well appreciated, however, by those doing a larger proportion of this class of surgery. One of the principal obstacles to successful results has been the difficulty of working in deep wounds. The type of motor saw in common use is directly responsible for this difficulty. The absence of a natural and accurate control of the rapidly revolving saw, in the ordinary instrument, has also prevented uniformly good results.

With the idea, first, of increasing the usefulness of the motor saw in deep wounds, and, second, of improving the control of the instrument, I began the construction of a new saw in the fall of 1920. It was completed in the spring of 1921, and has been in regular use in my practice, without alteration, since that time. In order to be additionally certain of its strength and durability, I have tested it extensively by sawing dry horse bone. It has done many times the amount of work that a busy surgeon would require of it in the same length of time. Examination of its parts at present shows no signs of wear. I believe it has been sufficiently tested to justify its presentation.

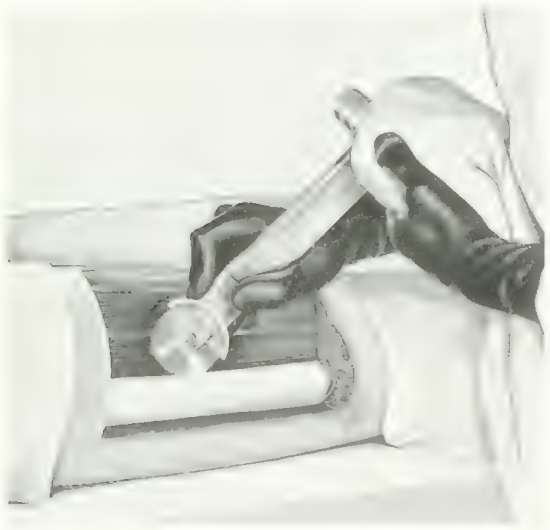

Fig. 1. Sawing on the femur with the Langworthy motor saw. This drawing, showing a section of the soft tissues of the thigh removed, illustrates, much better than do photographs, the relation of the operator, the saw, and the femur, since in actual use the saw is entirely out of sight in the narrow, deep wound. It illustrates how easily the saw can be projected into the wound, in this case approximately 3 inches deep, without endangering surrounding tissues. With the circular saw revolving, as shown, at the extreme end of the long, slender arm, which can be grasped like a pencil, with the fingers close to the saw, accurate and delicate control is assured.

Fig. 2. Laminectomy with my motor saw. This drawing, showing a section of the thick, spinal muscles removed, illustrates how easily the laminæ can be cut on each side of the spinous processes, allowing the removal of the necessary bone in one piece, thus eliminating the tedious work of removing the laminæ and spinous processes piecemeal with a biting forceps. The delicate control possible with this saw allows its use in this region, where the old saws would be extremely dangerous.

Fig. 3. Amputation of the [illegible] explanatory. It is impossible, with the ordinary saws, to cut squarely and continuously across the femur. This is quickly and cleanly done by means of the large, circular saw which is a part of the apparatus. No retraction of the tissues is necessary, since they are not endangered in any way.

The difficulty of working in deep wounds, with the saws in common use, has been recognized by all surgeons doing bone work. In the instruments with which we are familiar, the circular saw is placed directly on the end of the motor. This makes it impossible for the saw to be projected into a wound for a distance greater than its own radius, because the shaft of the motor impinges upon the soft parts. It has always been necessary that extreme care be exercised to prevent tissues and towels from being wound about the revolving shaft. It is true that much work has been done on the femur and humerus, in spite of the thick muscles which cover them. This has not been accomplished, however, by bringing the saw to the bone, but by bringing the bone to the saw. This has necessitated extensive [illegible] surrounding tissues. Is it not reasonable to assume that the [illegible] work on the femur and humerus, compared with that on other bones of the extremities, is due, at least in part, to the relatively greater trauma caused by these extensive incisions? Is it not further true that we rarely do as workmanlike a job on the femur as we do on the tibia? When we can do as neat work, and produce as little trauma on the femur as on the tibia, then surely our percentage of success in the former will begin to approach the 80 or 90 per cent which is being sustained in the latter. A glance at Figures 1 and 5 will explain, much better than further discussion, how the design of my saw permits the operator actually to approach the bone with the saw, without endangering surrounding tissues, through an incision which exposes only as much of the bone as is actually to be worked upon. It is unnecessary to bring the bone to the surface by making extensive incisions and dissections. Thus less trauma is produced, and the blood supply to the bone is less impaired.

It is conceivable that, by constant practice, one might learn to work quite accurately with a saw which is revolving on the end of a yard-stick, but, to be used with the greatest precision, a speed tool must be controlled easily, naturally, and directly. Therefore, to be used to best

Fig. 4 (at left). The saw ready for use. The motor [illegible] ered by a heavy, canvas bag. The handle of the [illegible] attached to the motor. The saw, with its guard, is attached to the handle. The large, circular thumb nut, by which the saw and its guard are attached to the handle, is clearly shown.

Fig. 5. This is the most important illustration. It shows at once how easily my saw may be projected into a deep wound, without any contact with the surrounding [illegible]. The handle of the [illegible] to the line of cutting. The left hand holds the motor, leaving the fingers and wrist of the right hand entirely [illegible]

Fig. 6 (at left). Attaching saw to handle. The short, square axle of the saw inserts easily in a square hole in the extreme end of the handle. The circular thumb nut on the saw guard screws down over the threaded post on the handle, and fixes the saw firmly to the handle. There is no spring device in this attachment.

Fig. 7. Slotting the transplant. When it is necessary to bend the transplant to fit over a curve, as in some of the operations on the spine, the transplant must be slotted. With the saws in common use this is a two-man job, the assistant holding the instrument on the edge of the table, and the operator holding the transplant and feeding it into the saw. The difficulty of sawing these slots accurately in this way is apparent. The photograph shows how this becomes a one-man job with my saw. This work has been done time and time again, as accurately as shown in the photograph, by surgeons using my saw for the first time.

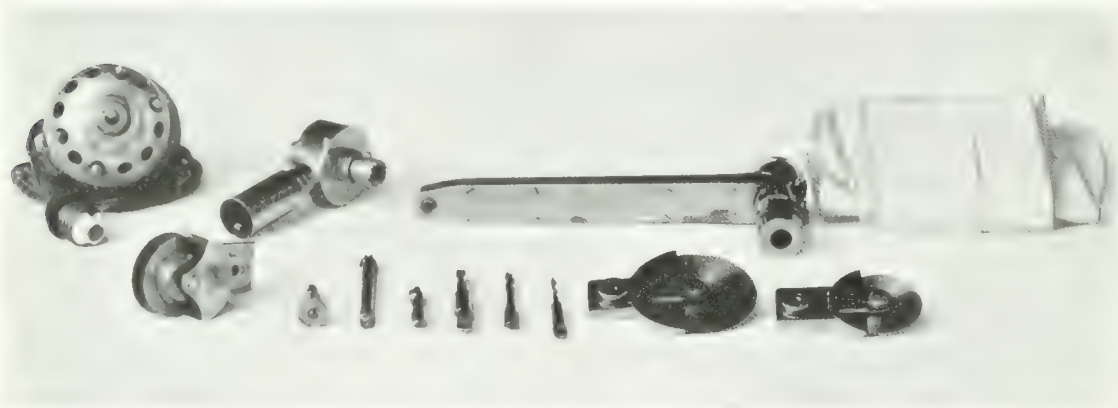

Fig. 8. The complete outfit for bone surgery. Upper row, left to right: (1) Motor. Sewing-machine type; runs on either alternating or direct current. The ordinary form of plug is shown, which connects the motor with the wall cord. No special electrical connections are used. (2) Dowel-shaper attachment for cutting round bone pegs of large or small size. (3) Handle, or saw arm. This is the most important part of the apparatus. It conveys the power of the motor to the circular saw, which is attached to its small end. It is narrow and thin, and is grasped like a pencil. It allows the saw to be projected into a very deep wound. (4) Canvas bag. This is made of heavy material, and covers the motor and its cord.

Lower row, left to right: (1) Twin saw. The two saw blades can be set quickly from one-eighth inch up to one-half inch apart. The narrowest separation can be increased in steps of one-twentieth of an inch each, up to the widest separation. (2) Small cross cut saw. (3) Large reamer, for use in preparing hole through greater trochanter, neck and head of femur, for insertion of a bone peg. (4) Small reamer. (5, 6, 7) Drills, large, medium, and small sizes. (8) Large saw with guard. The guard and saw are in one piece. (9) Small saw with guard. All parts are sterilized by boiling, except the motor, which is covered by the sterile bag.

Fig. 9.

Fig. 9. Attachment of drill and reamer. The cutters are simply inserted into the cylinder as here seen. The revolving chuck which holds them is enclosed within this cylinder, which does not revolve.

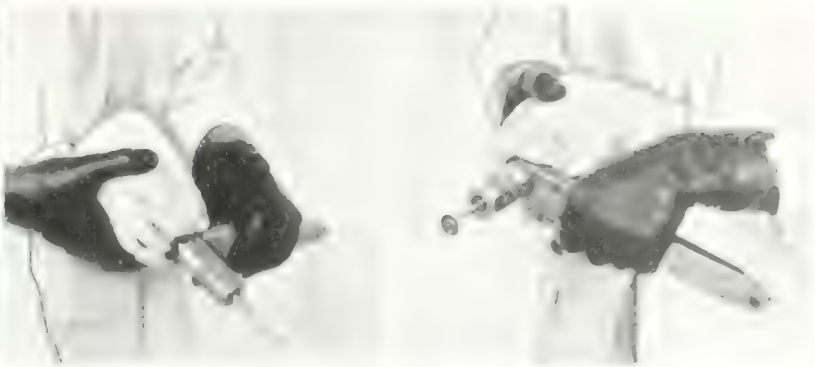

Fig. 10. Manner of holding the instrument, when using

Fig. 11. The small cross-cut saw is attached in the same

vantage, a motor bone saw, an instrument of precision, should be constructed so that it is handled as are the instruments of precision in common use. Such instruments are commonly held and handled as is the pencil; in fact, the most common instrument of precision is the pencil. Practice in its control is started in the kindergarten. The etcher, the engraver, and the watchmaker hold their instruments for fine work as they do a pencil. When we wish to use a scalpel or probe for very exact work, we grasp it like a pencil, with the fingers near the point. Another general factor in accuracy is the relative position of the eye, the tool, and the work. In the ultimate analysis, the eye must direct the tool. When the eye, the tool, and the work are in alignment, we are most accurate. It goes without saying that one hand will more exactly control the instrument than will two hands, provided the instrument is not too heavy.

The operator using the ordinary motor saw is handicapped in his attempt at accuracy, because it does not conform to any of the above general principles of accurate control. Reference to the general construction of the old type of saw will show that the pencil grip and accurate control

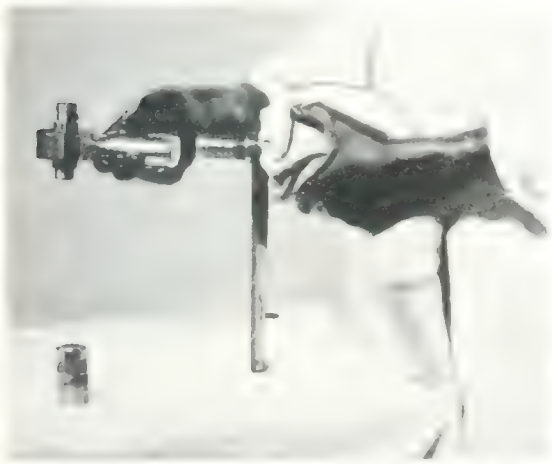

Fig. 12. Attachment of the dowel shaper. The cylindrical cap has been removed and placed on the table. This exposes the revolving chuck. The dowel shaper is slipped over this chuck, and screws down to the handle.

Fig. 13. Dowel shaper in use. The entire instrument is held firmly on the table by the left hand pressing down on

instrument, and is an excellent one.

motor occupies the upper end of the bag, which has been made larger for this purpose. The large end of the saw arm has been placed over the projecting end of the motor to the motor. The upper edge of the sterile bag is then turned up and tied with the drawstring around the projecting collar of the saw arm. The apparatus is thus made ready for use with the fewest and simplest movements possible.

through the wrist and fingers are not possible. The progress of the old saw along a straight line is produced by lateral movements of both arms and both shoulders. The muscles involved in such movements are not habituated to fine control. The fingers cannot be placed near the saw. The saw cuts in a line at right angles to the line of vision. Figure 5 shows clearly why my saw is so easily and accurately controlled. It is held like a pencil. The fingers are near the saw. The eye sights in a straight line directly over the saw. The weight of the motor is carried in the left hand, leaving the fingers and wrist of the right hand entirely free to control the movements of the revolving saw.

This new, bone-surgery apparatus has been made with fewer, simpler, and stronger parts than the old saws. Many manipulations, in assembling the parts after sterilization, have been eliminated. No spring catches are used in the attachment of the saws. They are held in place by a large thumb nut, which screws firmly to a strong, threaded post. Each saw has a guard which protects the fingers, and which keeps the saline solution, which is dripped on the saw, from being sprayed about promiscuously. The saw handle is attached to the motor with a simple thread. There is nothing mysterious about the motor. It is the ordinary sewing-machine type, which runs on either direct or alternating current. All parts are sterilized by boiling, except the motor and its cord, which are covered by a sterile, heavy canvas bag. This ties firmly around a collar on the saw handle. There is only one electrical connection to be made, and this with an ordinary connection-plug and socket. The old type of saw requires a special cord with two special connections, one to the motor through the metal shell, and the other to the wall cord; the former is a source of considerable difficulty at times.

My new, bone-surgery apparatus is made complete by the additional provision of a small cross-cut saw, an adjustable twin saw, different-sized drills, reamers, and a dowel shaper. To avoid a useless repetition of details, the different parts, and their uses, are described fully in the legends accompanying the illustrations. These make more apparent than text the ease with which routine bone work can be done. They also show how the use of this motor saw can be broadened to include amputations, the removal of various-shaped sections of bone, as in the radical operations for chronic osteomyelitis, or bone tumor, and the operation of laminectomy. The technique of laminectomy, and other operative bone work, in which a motor saw has not previously been used, will be taken up in other articles. From the several illustrations which show the saw in use, it can be readily seen with what facility it can be used, both in the most accessible and inaccessible places. This saw does not solve all the problems of bone surgery, but it does simplify a few of them.

SUMMARY

1. My new motor bone saw can be used easily in narrow, deep wounds.

2. It can be used easily and accurately, because a) it is held like a pencil; (b) the fingers grasp it close to the revolving saw; (c) when sawing, the eye sights directly over the saw in the line in which it is cutting.

3. The various parts, and their means of attachment, are extremely simple and strong.

4. Sawing, drilling, reaming, and dowel-shaping are easily done.

5. This motor saw can be used in many regions which previously were inaccessible to a motor saw.

METHOD OF LOCATING AND BLOCKING NERVUS CUTANEUS COLLI

By J. B. McNERTHNEY, M.D., F.A.C.S., Tacoma, W[illegible]

LOCATING the nervus cutaneus colli is determined by what may be called squaring the region. Successful anæsthesia is based upon a thorough knowledge of anatomy and exact technique. The art of local anæsthesia has successfully progressed in proportion to the operator's skill always to apply the anæsthetizing solutions to the nerve trunk supply within a certain area by means of a safe, simple, and sure method.

The nervus cutaneus colli arises from the second and third cervical nerves. It climbs the posterior margin of the sternomastoid muscle and passes transversely forward supplying the platysma in part and a large cutaneous area on the anterolateral surface of the neck.

Drop a vertical line from the center of the mastoid process, meet this with a transverse line from the mental protuberance of the inferior maxillary bone, and exactly at the intersection of the two lines within an area the size of a ten cent piece will be found the nerve.

Previous to the operation the region is squared, and the location of the nerve is marked with silver nitrate or by any other method the surgeon chooses.

Infiltration of the skin and subcutanous tissue within the small marked area allows the needle to pass painlessly over the posterior margin of the sternomastoid muscle to meet the nerve. Here sufficient novocaine solution is placed to intercept the nerve trunk.

Drawing showing author's [illegible]ing nervus cutaneus colli.

BENZYL SUCCINATE IN DYSMENORRHŒA[1]

By JOSEPH J. MUNDELL, M.D., F.A.C.S., Washington

THAT woman has suffered pain at her menstrual periods and that relief from the same has baffled her medical attendant from time immemorial is testified to by the voluminous literature on the subject extending from the current journals backward in an unbroken chain into ancient times and, strange as it may seem, the most recent of the current articles are not a great deal more enlightening than some of the earliest contributions, nor will the present feeble effort be an exception in this much treated but little explored field, but will simply relate some observations made in the treatment of a large number of girls during the past few years.

In the earliest medical work extant, the *Papyrus Ebers*, 1550 B.C., it is stated: "When you make an examination of a patient and find that she has disease on one side of her womb, you tell her that she has an obstruction to her menstruation, then having made your diagnosis, prepare a remedy which is applied to the womb." In this the point is stressed as we find it almost harped upon in the majority of late writings, namely, that a correct diagnosis must be made before instituting treatment. Yet, having made such, it is hard to see where much progress is made in the solution of the main issue in the problem, to give relief. It is very interesting to note that the present day adherents of the mechanical treatment of dysmenorrhœa have ample authority as far as precedence goes in their methods, for as early a writer as Hippocrates in a "Treatise on Stenosis and Rigidity of the Cervix," gives an elaborate and detailed description of his method of dilatation by means of a series of gradually enlarging pine rods, which he cautions should be as round and as smooth as possible and have no splinters. If one is not satisfied with this venerable authority, he has to but consult the next best known ancient, Soramus, to find that he also advocates such a procedure, for he says that a menstrual flow which comes only drop by drop is relieved by dilating a too small uterine orifice. If desiring the sanction of authors who do not bear the stamp of such antiquity, we find that at one time in early English history the mechanical treatment was prevalent to such a degree that doctors sat on their front door steps extolling the virtues of their individual stem pessaries.

Regarding the etiology of this condition, there is so much confusion, and there is such a multiplicity of divergent views that one has the choice of any number from which to pick. There are any number of writers, probably the majority, who are firm in their belief that the pain is due to mechanical obstruction within the uterus: stenosis, flexion or what not. Notable among these writers is the famed Marion Sims, who declaimed that without obstruction there could be no dysmenorrhœa. There are numerous others who loudly assert that this is erroneous and they present a variety of theories of causative factors, chief among them being a disturbance of the sympathetic nervous system, which in some instances is fancifully detailed; others give just as capricious explanations of the derangement of the hormones and the endocrines. Endometritis as the causative factor has long since been an exploded supposition. Hyperæsthesia of the circular muscle fibers of the cervix similar to pylorospasm comes from another source. Hypoplasia and mal-development is given by others as a rather plausible coincidence in certain instances. Prominence is given to blood changes by many and probably rightly so, as changes in the clotting properties of the blood, due to the action of the ferments of the uterine glands would undoubtedly result in pain in the expulsion of clots. Other biochemical questions are raised and in fact there is a veritable maize of theories and hypotheses, but nothing definite and tangible has been brought out, for the simple reason that we are dealing with an undetermined pathological entity, and by the very nature of the subject matter it seems to be a hopeless task.

When the pathology of the condition is worked out to the satisfaction of all concerned, then and not until then will we be on the right road to the solution of this time-worn controversy.

As we have seen the myriad of suppositions expostulated in the etiology, so do we find just such a jumble in the classification. No two textbooks give the same classification, and indeed it seems that each writer upon the subject, and they are legion, seems to assume it his divine right to present his own pet classification, for I have counted in the literature no less than 70 types. In this day of standardization, it seems that it might not be amiss to suggest that the section on gynecology and obstetrics of the American Medical Association or one of the

[1] Read before the District of Columbia Medical Society, January 25, 1922.

national gynecological bodies gives this their consideration.

With full knowledge of this chaotic state of affairs and only after deep reflection have I the temerity to join the multitude and offer an original simple classification, up to date, my reasons for such a presumption. My classification is: (1) mechanical and (2) endocrinal.

MECHANICAL

It is conceded by the majority, practically all, of the writers that there is an *obstructive* type of dysmenorrhœa and this seems to be the only common meeting ground in the consideration of the whole matter. Opinions differ widely as to the cause and treatment of the obstruction. It seems reasonable to assume if an obstruction be present no matter whether it be congestive in origin or due to a flexion, it is by all means mechanical in its action. There are many who believe that the obstruction is due to congestion, or hypoplasia of the endometrium, which may be granted, but nevertheless this naturally acts mechanically in the production of pain. Under this heading, of course, comes acute anteflexion, which is so commonly found in young unmarried and nulliparous married women. Not all cases of acute anteflexion produce pain, but the condition is so frequently found in unmarried girls, who suffer severe menstrual cramps that it seems unreasonable to suppose that it is not a factor. Other malpositions of the uterus, retroversion being the next most common, come next in importance. Also, included here would be pelvic inflammatory disease, acute or chronic, such as salpingitis, metritis, oophoritis, cellulitis, and appendicitis; also pelvic or abdominal tumors and uterine polyps.

Too many cases have been relieved by surgical measures to doubt that there is a mechanical type of dysmenorrhœa.

ENDOCRINAL

Here we enter the realm of mysticism, wherein the dreamer may soar to celestial heights to his heart's content. I offer it as a cloak as yet, but beyond a doubt, in this field will some one be discovered the solution of this vexed problem. Many healthy, robust, athletic patients present themselves for treatment in whom repeated careful examinations fail to reveal the least vestige of abnormalities. For convenience these are placed in this category. There are many rollicking obese girls, who menstruate irregularly, perhaps two or three times a year, and then painfully, in whom physical examination reveals nothing abnormal. Truly these patients rightfully belong in this class. We are all familiar with the patients who present a picture the counterpart of the latter: Slender frail girls, filled with nervous energy, working hard at whatever task they have, assuming all the responsibilities of home, always fretting, and who never marry. Though usually irregular they always suffer and as years go by become more or less invalids at their periods. Seldom do we find any demonstrable pathology in these girls and plainly they are included under this heading. Next comes a most puzzling group, the general looking differing from those preceding, however, in that here we do find something palpable. I refer to women in whom we find underdeveloped or infantile uteri, who frequently suffer menstrual cramps. It may be said that it is only by a stretch of the imagination that we ascribe the undevelopment of the uterus to the endocrines. Because I believe there are few if any who can deny that some disharmony in the endocrine system is responsible for the undevelopment of the uterus, I believe I am safe in placing this variety here, and am content not to offer any further argument for so arranging it. Any ovarian disease, or for that matter disease of any ductless gland producing an overactivity or diminution in ovarian secretion coexisting with dysmenorrhœa would be considered causative of the dysmenorrhœa and would naturally be placed in this category.

It is feasible to assume that in the same individual a complexity of factors may co-exist producing a combination of the two types, for instance a girl with acute anteflexion who is also suffering with hyperthyroidism.

It is often said that dysmenorrhœa is but a symptom. Be that as it may, it has been well established on innumerable occasions that our efforts at symptomatic treatment have met with ignoble defeat. It is harped upon in many writings that successful treatment depends upon correct diagnosis. This in a measure is probably true, but I think only as it regards the exclusion of the intrapelvic mechanical obstructions. If one is fortunate enough to succeed in diagnosing a case as of the mechanical type and relieve the pain by some surgical means, he is indeed to be congratulated. If, however, in a girl presenting herself for treatment, we realize that hers is not an uncomplicated mechanical type, but that there are other factors present, bringing the case under the general classification of endocrinal, what have we to offer her? What can we prescribe, saying this will cure you?

All textbooks advise against the use of alcoholics in the treatment of this condition, but the remedies most popular among the laity are, gin, ginger, viburnum compound and helonin compound, the two latter containing a much larger percentage of alcohol than gin. If one is of the opinion that these remedies do not give relief in quite a large number of instances, he has but to question women, who use them. However, one hesitates to prescribe remedies of this character if something else can be found which is quite as efficacious.

During the past few years I have had to cope with this condition, symptom or symptom complex, as you wish, upon a large scale. At first I floundered around trying one method after another with little success. Only those who suffered severe pain would submit to examination. Of these there were many in whom were found gross pathological conditions, such as inflammatory disease of the adnexa, etc., which will not be considered here, for naturally surgery is indicated in such cases. Of those in whom acute anteflexion was diagnosed and who consented to surgical treatment there were 25 cases treated by dilatation and introduction of a Wylie stem pessary, which was retained from 1 week to 3 months. In one case an infection was either lighted up or was introduced and she suffered much pain more or less constantly for several months, when she was lost sight of. Two other cases were affected in a similar manner, but to a lesser degree. Ten cases reported marked benefit and the remainder were only slightly improved. About 25 cases were referred to a rhinologist for treatment of the genital spots, as described first by Fleiss, but the results as reported by the patients were so discouraging that this method was abandoned.

Quite a few selected cases of the evident endocrinal type, slender frail, neurotic girls of questionable age, quite plainly not of the vamp description, in whom physical examination revealed no gross pathology, were followed faithfully for several months under intensive treatment with corpus luteum extract and thyroid extract with little or no improvement.

Finally with the introduction of benzyl benzoate by Macht and the later report of its use in dysmenorrhœa by Litzenberg, I adopted it with rather satisfactory results. The early preparations in emulsion were most unpalatable and distasteful. This feature was overcome later by using globules containing the drug in oil; later it appeared in tablets and lately this seems to be superseded by 5-grain tablets of benzyl succinate, which I have been using for some months.

More than two hundred patients have been treated but these observations have been adduced from a series of 80 patients, treated from April, 1920, to October, 1921, who were asked for an expression of opinion as to the benefits derived. This report is based entirely upon the statements of the patients and naturally such a report is not altogether accurate, but it is hard to conceive how conclusions can be arrived at by any other method.

No attempt was made to classify these cases as mechanical or endocrinal for none of the patients would submit to an examination, but as they applied for treatment first benzyl benzoate and lately benzyl succinate was prescribed as a routine with the request that the result of treatment be reported after each period. To insure an unbiased opinion the report was made through a nurse in order that I would not in any way influence their statements. The routine now is two 5-grain benzyl succinate tablets every hour until relief is obtained. Those who reported benefit usually obtained it within 3 doses, some few took as many as eight doses. The majority reported for only 1 or 2 months, a large number reported for 3 months, several reported for 6 months and a few for 8 months.

The severity of the pain is graded as A, B, C; mild cramps under A, moderately severe under B, and very severe under C, and of these we had:

A	40 cases
B	17 cases
C	23 cases

The results are graded as 1, 2, 3; good as 1, fair as 2, poor as 3; of these we had:

1	52 cases
2	20 cases
3	8 cases
Primary	32
Secondary	23
Not stated	25

Six patients reported no benefit whatever. No bad effects from the administration of the drug were reported or observed. Of the 80 cases the pain began before the advent of the flow in 26 and after the flow in 28 cases and in the remaining 20 cases it was not stated.

If after a fair test for 3 or 4 months no benefit is reported, investigation should be made looking toward classification and further treatment.

The conclusion adduced by the analysis of this series of cases would seem to be that benzyl succinate will not cure dysmenorrhœa, but that it relieves the pain and cramps equally as well and probably much better than any other drug or method of treatment of which we are conversant today.

PROLONGED AND PROFUSE POSTOPERATIVE DRAINAGE OF PANCREATIC CYST AND USE OF RADIUM

By CHARLES S. HAMILTON, M.D., F.A.C.S.,

TRUE cysts of the pancreas are not frequently seen by the surgeon. In reporting the case detailed below it is not my intention to discuss the etiology, symptomatology, or [illegible] treatment of these cysts. The point which I desire to call attention to is the prolonged postoperative drainage of these cysts when the cyst is not radically extirpated.

The case I wish to report was one in which postoperative drainage persisted for 8 months and in which I applied radium postoperatively with apparently good effects.

American housewife of forty entered hospital September 9, 1919. Mother and a brother died of cancer. Patient's general health has been good. She has been married [illegible] years. She has had [illegible] heaviest weight [illegible] 98. Habits are good. She is subject to attacks of epilepsy. Patient had a "fainting spell" 8 weeks ago and fell while carrying a bucket of water at her home. She became unconscious and remained so until next morning. [illegible] she noticed pain in the left upper quadrant of her abdomen, with swelling. Physician told her there was a tumor present. She had never noticed this enlargement before. Following this her abdomen became bloated and was tender.

Two weeks after the first attack, about July 28, 1919, the patient was operated upon by a surgeon who told her the tumor was a cancer. At the time of the operation he inserted a tube which drained cloudy fluid in abundance.

Three weeks later patient was operated upon by the same surgeon who reported again that she had [illegible] Her physician stated subsequently that the surgeon found inoperable ovarian cyst. By this time the swelling had disappeared, but there was still drainage of fluid through the tube for a week, and following this from the sinus that remained. It was irritating to the skin at this time.

On entering Mt. Carmel Hospital, September 9, 1919, examination showed a slender, sallow woman weigh[ing] pounds. The [illegible] dullness over the left upper quadrant. Liver dullness normal. N[illegible] scar of a low median laparotomy incision 6 [illegible] The scar of the second operation was 2 inches long, slightly to the left of the umbilicus. In it there was [illegible] charging a clear unirritating fluid. The p[illegible] tremities were negative. Before operation temperature was 97, pulse 86, respiration 24. Urine showed [illegible] gravity 1006, and was negative for albumin and [illegible] There were a few hyaline casts. Other findin[illegible] tive. Blood count not recorded. Wassermann ne[illegible] Methylene blue excreted in urine but not in the di[illegible]

Operation September [illegible]. [illegible] of the umbilicus was opened and the adhesion [illegible] released. A tumor was found which proved to a pancreatic cyst extending toward the left kidney, and to the right just beyond the median line. Fluid escaped freely during operation. The cyst had been opened between the stomach and colon. A tube was sewed in the cyst and brought out of the upper angle of the wound with a strip of gauze leading [illegible] the tube. The abdomen [illegible] The pelvic organs [illegible] normal.

[illegible] recovery following operation. A [illegible] 20 all the secretion could be collected. A [illegible] undoubtedly pancreatic secretion. The amount of drain-

[illegible]	30
[illegible]	24

[illegible] Dr. Kirken-

[illegible]	
[illegible]	
[illegible]	20
[illegible]	
[illegible]	

used in full depth of fistula withdrawing it 1 inch every [illegible]

[illegible]	
October 31 [illegible]	8
[illegible]	
[illegible]	
November 3 [illegible]	6
[illegible]	
November 5 [illegible]	8
November 6 [illegible]	16
[illegible]	
[illegible]	
[illegible]	
[illegible] ember 10 [illegible]	30

[illegible] a 50 and two 25 milligram tubes, unscreened in [illegible] 10 minutes.

[illegible]	
November 1	
November 13 [illegible]	13
November 14 [illegible]	5
[illegible]	
[illegible]	
[illegible]	
[illegible]	
[illegible]	

November 21, radium was used again. 25 milligrams un[illegible]d, to the full depth of the fistula for 8 hours. [illegible]

[illegible] the patient was discharged from the hospital with the sinus draining 11 ounces in 24 hours. The tube had been removed before she left. It was feared that [illegible] might lose the tube in the wound.

Patient gave the wound little attention after leaving the hospital and the sinus closed after 3 weeks. This wound was [illegible] and she continued to improve. Her appetite was good and she gained 10 pounds in weight.

Two months later she had severe pain and swelling in the left upper quadrant and epigastrium. This lasted 4 days and associated with it was loss of appetite, nausea, and vomiting. During the night "something burst" and the wound reopened and discharged fluid again. This immediately relieved her pain and distress. She did not measure the fluid, but the fistula required three dressings daily. The fistula persisted until her return to the hospital.

January 31, 1920, second entry.

Without anæsthesia a tube was inserted into the sinus and a bottle attached as before. There was leakage about the tube so that an accurate account of the amount could not be kept. Discharged from the hospital on February 28, draining 2 to 3 ounces of fluid in 24 hours. No radium was used, but a drainage tube was left in the sinus on this occasion.

After returning home the sinus became so small that she could not replace the tube so she left it out and the sinus closed again after 2 weeks.

April 10, 1920, third entry.

Her wound was entirely healed and there was no tumor felt in the abdomen. Her health was perfect and she was able to do her own housework. Abdominal examination showed two healed scars and no signs of fluid. There was no left upper quadrant dullness as before. As a precautionary measure, radium was used: 100 milligrams (1 millimeter lead, 1 millimeter rubber, 1 millimeter gauze screen) to the abdominal areas, 3 hours each.

The particular matters I think worthy of attention in connection with this case are: (1) the failure in diagnosing the true nature of the cyst after the first operation for supposed ovarian cyst; (2) the persistent drainage and the large amount of secretion; (3) the comparatively slight skin excoriation due to the discharge; and (4) the value of radium in such cases.

As regards (1), cysts of the pancreas are rarely diagnosed prior to operation. Before coming to us this patient had been twice operated upon by another surgeon who on the last occasion informed the patient's physician that an inoperable ovarian cyst had been found and drained. On the patient's entrance there was a profuse non-irritating discharge which had persisted for the 2 weeks since her operation. She was placed under observation for a further period of 2 weeks. While no sign of ovarian cyst could be felt *per vaginam* I was influenced unduly by the statement of the surgeon who had previously operated and assumed that he had drained an inoperable ovarian cyst. A chemical examination of the fluid, if made then, would have cleared the diagnosis at once. On re-opening the abdomen, however, the supposed ovarian tumor was found to be a pancreatic cyst as stated in the case report.

With regard to the persistence and quantity of the secretion, this, during the time it could be measured, varied from 6 or 8 to 30 ounces per 24 hours. When the patient first left the hospital 2 months after I had operated, the sinus was draining 21 ounces in 24 hours. The wound closed temporarily but months later re-opened and again secreted. When the patient was discharged from the hospital a second time, the wound was draining at the rate of 2 to 3 ounces in 24 hours until the fistula permanently closed. The more or less profuse drainage in this case with or without an inserted tube had lasted from the end of July, 1919, to March, 1920, a period of about 8 months after which no clinical evidence of the presence of fluid could be detected and the fistula had definitely closed.

I have had experience with pancreatic cysts in 2 previous cases, but in neither of these was the secretion collected and measured systematically as in this case. However, I can state that (1) in my previous cases there was a rapid diminution of secretion while the patients were in the hospital; and (2) in neither of the patients did the discharge at any period reach 30 ounces in 24 hours. Cushing records discharge of from 500 to 600 cubic centimeters daily. In a case reported by Mason the drainage continued for 43 days, 9½ ounces being the largest amount secreted in 24 hours. Kerr reports a case of pancreatic cyst drainage persisting 15 years with "about half a pound of fluid discharged daily" but which did not prevent the patient from working. Although the amount of the discharge in my case is exceptionally high the persistence is not exceptional. Koerte reported a case in which a fistula persisted for 2½ years. In the case of Murray and Gies the fistula had not healed after 3 years and in Kerr's case above alluded to the fistula and heavy discharge continued for 15 years.

Despite the heavy discharge and leakage of the drainage tube but little skin excoriation was experienced by the patient except in the period immediately following the first operation. When the patient came to me the discharge, though profuse, was not irritating to the skin. Usually the fistulous discharge is excoriating.

Judd reporting on 31 cases of pancreatic cyst treated by drainage in the Mayo Clinic states that most of the wounds drain for several weeks, some for several months, and a few for several years. According to Judd, drainage continues until the mucous membrane lining the cyst has

been completely destroyed. It seems, therefore, desirable to strip out any mucous lining which can be removed without inducing much hæmorrhage, and this course was followed by Judd in a number of cases with apparently good effect. The injection of fluid into the cystic cavity to shorten the drainage period is said by Opie and others to be a dangerous procedure.

Johnson says that the time limit for the automatic closure of a postoperative pancreatic cystic fistula has been arbitrarily fixed at 9 months, and that unless it persists beyond that period operative measures for its exclusion are not indicated.

The fourth point to which I wish to allude is the use of radium in this case. I find no reports in the literature of radium having been used to accelerate the healing of pancreatic fistulæ. After I had operated upon this patient and the wound had steadily drained from 20 to 30 ounces each 24 hours for nearly a month with no tendency to diminish, the radium treatment was instituted with some apprehension as to its effects on the secretory power of the pancreas. Following the first application of radium, the discharge diminished to 16 ounces within 5 days when the second application of radium was made. In the week following this second application the discharge fluctuated, going as low as 6 ounces in 24 hours. In the next few days the discharge again increased and reached its old maximum of 30 ounces when the radium was applied for a third time. From this time until discharge the daily flow averaged 20 ounces.

I have no reason to believe that the cure in this case can positively be ascribed to the radium applications, but the reduction in the amounts of the discharge following the first and second applications is rather remarkable when it is remembered that the cyst had been steadily draining profusely for [illegible] might judge [illegible] nite continuation of the drainage process might be expected. Following the use of radium, an irregular diminution of the secretion was observed and an eventual complete cure. How far the radium was responsible for this result is a debatable matter, as it is a well known fact that drainage cures pancreatic cysts. Judd, basing his opinion on the very large number of cases of pancreatic cyst treated at the Mayo Clinic, [illegible] "The results from drainage of the cystic contents are very satisfactory except for the rather prolonged convalescence . . . and the results were just as good in those which were drained as in those in which the cyst was removed."

Therefore, without attempting [illegible] definite deduction regarding the value of radium from its use in this case, if it is used in other similar cases with equal results it might reasonably be considered as of value in shortening the prolonged period of drainage and convalescence and hence its use may be considered as a progress in surgery of the pancreas, and possible extension to other postoperative fistulous conditions.

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HARMFUL USE OF CATHARTICS AFTER ABDOMINAL OPERATIONS

By LEROY LONG, M.D., F.A.C.S., Oklahoma City, Oklahoma

IN considering the use of cathartics after abdominal operation, I wish to submit two propositions, each followed by an argument to support it.

1. CATHARTICS ARE OF NO SERVICE AFTER AN ABDOMINAL OPERATION

The truth of this has been demonstrated to my satisfaction through a personal experience as a general surgeon covering a comparatively long period of time. For about 11 years I have not given cathartics after abdominal operations, and the patients have been decidedly more comfortable than in previous years when cathartics were given. I cannot now conceive of a condition that would indicate cathartics after abdominal operation. If food is withheld, if alkaline water is instilled per rectum, if a colon tube is introduced at intervals well within the sphincter and left there when there is distention, if morphine is given as necessary to keep the patient comfortable, it is gratifying to see the perfectly satisfactory course the average patient pursues. On the third or fourth day, if the bowels have not already moved, a low enema of warm water — 1 pint only — is given, and there is usually an evacuation without delay. If there is not, there is no hurry, and the enema is not repeated until perhaps the next day. Patients usually are discharged without ever having had a cathartic either before or after operation.

Meteorism or distention is, in my judgment, a most positive contra-indication for the administration of a cathartic, and yet I am aware that I am taking issue with many surgeons who feel that active measures of this character should be carried out. If there is nausea and vomiting, wash the stomach, give a hypodermatic dose of morphine, introduce a colon tube through the sphincter occasionally, and let the patient alone. Repeat the morphine if necessary — it is rarely necessary oftener than every 4 to 6 hours. But do not, under any circumstances, give cathartics, nor eserin, nor pituitrin, either of which is as bad or worse than cathartics. During my experience of 11 years there has not been, in my own work, a single case of ileus in patients treated in this way, nor have I, in looking back, been able to find one single instance in which my conscience troubled me because I did not give cathartics. I firmly believe, therefore, that cathartics after operation are not only unnecessary, but that the postoperative course is delightfully more smooth and more comfortable when they are not employed.

2. CATHARTICS AFTER ABDOMINAL OPERATIONS MAY PRODUCE DISAGREEABLE SYMPTOMS, AND THEY TEND TO THE PRODUCTION OF DANGEROUS CONDITIONS, SUCH AS ILEUS

This proposition may be changed so that it will appear in a more graphic way in the following syllogism:

Any agent which produces irritation of the intestinal tract is dangerous after an abdominal operation. Cathartics produce irritation, therefore cathartics are dangerous agents and should not be given.

I believe that this syllogism expresses the views of a vast number of surgeons, but a perusal of current literature, some of it coming from teachers and clinicians of reputation, would lead one to believe that it is still the general practice to give cathartics whenever any important symptom referable to the intra-abdominal organs arises after operation. For instance, one clinician of national reputation, in discussing ileus after appendicitis operations, in a comparatively recent article (1) makes this statement: "Paralytic ileus is sometimes a serious or even fatal complication. It is here that proper early use of saline cathartics has been of value." In the same article he advises a teaspoonful of castor oil every hour "until peristalsis with expulsion of gas and fæces is secured." Another, writing from a large Canadian clinic, in an article (2) about 8 months ago, states that the practice in that clinic is to give castor oil at the end of 48 hours, and then pills of aloin, strychnine and belladonna as necessary. Since this author in the same article reports a case in which the rectal injection of two drams of tincture of digitalis in 3 or 4 ounces of water caused the bowels to move freely in 2 hours through its action on the vagus, I assume that his opinion with reference to the physiological action of drugs is at least open to question. There are still many others who begin the administration of cathartics even within the first 24 hours, calomel in divided doses being the drug frequently employed.

I believe that the practice referred to, especially in the presence of marked meteorism, or even evidences of ileus, is an unfortunate, not to say

pernicious practice; I believe that the influence of such teaching is baneful in the extreme.

Normally, there are two main forms of movement in the intestinal tract — the peristaltic and the pendular or rythmic. Normal peristalsis produces constriction of the walls of the intestine beginning at a certain point, and passing by successive constrictions downward away from the stomach. These constrictions pass successively from segment to segment, each constriction being preceded by an area of inhibition or relaxation, and followed by gradual relaxation. Bayliss and Starling (3) regard this as a reflex which is controlled within the intestinal wall itself through its intrinsic ganglia and their afferent and efferent connections. Rhythmic movements consist of a series of local constrictions of the intestinal wall, the constrictions occurring normally in a uniform and orderly way as a result of local stimuli. These movements are brought about through, first, muscle "tone" which the physiologist defines as a state of continuous shortening or contraction, slight in extent, due to the discharge of subminimal nerve impulses into the muscle, and, second, to the normal "contraction" of the musculature, it being understood that in the musculature of the intestinal tract, in common with the phenomenon in smooth muscle generally, contraction is relatively infrequent, and that it takes place in a leisurely way after a long, latent period, and is followed by a long period of relaxation. In the orderly movements of the intestines there is no distress, and the individual is unconscious of their existence. The flatulence, the colic-like pains, the griping after cathartics, are manifestations of the fact that orderly movements are destroyed to a greater or lesser extent. The most violent interference with these movements takes place when the mesenteric circulation in the intestinal walls is interfered with, which is a common enough result of catharsis in the presence of many postoperative conditions.

It has been pointed out by a recent writer (4) that during anæsthesia there is paralysis of the nervous mechanism that controls the viscera as well as that of the voluntary musculature. It is argued, therefore, and obviously with reason, that gas colic is primarily the result of paresis of the intestines, and not due to fermentation.

I think that it will be conceded that in practically every abdominal operation there is more or less trauma to the intestinal tract. Even in an interval appendicitis the cæcum is handled, there is a wound left on one side of it, and often, doubtless, the circulation of the blood is interfered with —and sometimes greatly interfered with. Think for a moment of a few examples of intra-abdominal pathology. [illegible] bladder [illegible] drainage [illegible] spreading peritonitis. Recall the cases of tumors and pus tubes and [illegible] vis. Just visualize the general run of abdominal operations, and I am sure that you will agree that in all, despite care and training and dexterity, [illegible] inflicted; in the septic cases it is inflicted and is an additional insult to an already crippled abdomen filled with 25 or 30 feet of intestinal tract [illegible] which are already embarrassed or destroyed.

Given an intestinal tract that has recently been paralyzed; an intestinal tract that has been traumatized; an intestinal tract that, perchance, has been caught in the tentacles of a spreading peritonitis, or that is helping to support the walls of an abscess, what would be the natural conception of the condition of such an intestinal tract with reference to the effect upon its normal movements? [illegible] without additional irritation, for anything like normal movements to take place? Under these circumstances, would any clear thinking man wish deliberately to place upon the crippled musculature an additional load? And yet that is exactly what happens when a cathartic is given after an abdominal operation. It is difficult to [illegible] splint and bandage and sling for an arm with damaged musculature, but who has [illegible] of mind nor calm of conscience if he suspects that the intestinal tract in his last operative case is quietly resting and regaining its lost tone. The administration of a cathartic [illegible] as those to which I have referred, destroys the normal movements, whips up the musculature — a musculature with deficient tone — so that violent effort succeeds violent effort, and surging wave follows surging wave until a traumatized area is reached, or an area fastened to inflammatory [illegible] when the force of abnormal effort is turned back. Isometric contraction succeeds isotonic contraction because the load is too heavy; the barrier too high. Under the abnormal conditions, there are fibrillar contractions — that is, "separate fibrils or bundles of fibrils contract at different times, giving a flickering, trembling movement to the muscle" (5). Finally, fatigue comes with the abortive idiomuscular contraction of exhausted or dying musculature.

Whatever may be argued in favor of the administration of cathartics under ordinary circumstances, to advise that they should be administered in the presence of symptoms of ileus, or even marked meteorism, is, in my judgment, a position that is untenable on anatomical, physiological, and pathological grounds. Such employment of cathartics in many cases leads straight to ileus. In no other way can I explain why for 11 years without postoperative catharsis, one has managed to escape without a single case of ileus in those so treated. Meteorism has been a problem many times — the same kind of meteorism that formerly got cathartics, and formerly some of them ended in ileus. One is told that it is due to improved technique, through which trauma is minimized, but that does not explain it, even if it were true, for from the hands of surgeons the country over, surgeons who use good technique and bad, the reports of postoperative ileus continue to come. In a compilation by McGlannan (6) recently brought to my attention, there are listed 276 cases of intestinal obstruction of all kinds, and 10 per cent of them followed drainage operations for appendicitis.

In a group of about a dozen patients in which I have done an enterostomy for the relief of postoperative ileus during the last 5 years, all but three had been given cathartics after operation. Of these three, two were late, and the obstruction was due to rapid recurrence of malignant neoplasms. In all of these the picture inside the abdominal cavity was essentially the same: the bowels blown up and thinned out almost as thin as paper, with a little fluid about the coils. With the exception of the two cancer cases, they were all cases of paralytic ileus, at least no mechanical obstruction was made out, and in those recovering the bowels finally moved in the normal way, the fistula of the enterostomy opening closing without secondary operation.

In these cases the bowel walls were so thin that they were several times accidentally penetrated while suturing, as evidenced by a little leakage at a needle puncture, although small needles were used. It would be enlightening for all those who believe in postoperative catharsis to observe the intestinal tract at such an operation—a tract so distended and with such thinned-out walls that one wonders if it is possible that there was once a musculature in relation with it. H. T. Hicks (7) reporting a case of paralytic ileus, describes the picture just as I have seen it, and his report agrees exactly with reports of many other surgeons. In his case the bowels moved per rectum after temporary relief through an enterostomy tube, and he remarks that "this shows a general recovery of all the paralyzed bowel." Ashhurst (8) appropriately says: "In cases of adynamic obstruction the patient is not ill because his abdomen is distended, but his abdomen is distended because he is ill."

What shall we do then, for the postoperative patient? Give him water per rectum until he can take it in the normal way without nausea. When he is uncomfortable inject morphine. Introduce a colon tube just well above the sphincter and leave it there if he has much gas, withhold food for 3 or 4 days. If he has meteorism, do not give a cathartic, do not give eserin or pituitrin, for they are deadly agents here, but wash out the stomach, give morphine and instill water per rectum, alternating with colon tube. The central idea is to permit the intestinal tract to drain itself, but do not try to drive the contents through it, for its dynamic force is impaired. It should not be our object to whip up a crippled musculature. It should be our object—indeed, I verily believe that it should be our sacred duty—to give it rest, for through rest only can recuperation and recovery take place.

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EDITORIALS

SURGERY, GYNECOLOGY AND OBSTETRICS

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NOVEMBER, 1922

THE PROGNOSIS OF FRACTURES

IT is narrated of Charles XII, of Sweden, that when, in 1702, he sustained a fracture of the femur in a fall from his horse, he would suffer confinement to bed no longer than 6 weeks; after this short interval he resumed his usual activities, which consisted in spending most of each 24 hours in the saddle, in violent physical activity. While the result in this case was perfect function, presumably without noteworthy deformity, the method of treatment does not appear to have been recorded, so that we cannot argue from cause to effect.

Now from that day to this, or even from earliest historic times to our own, the time required to secure union in a broken bone has not appreciably varied; the reparative processes are precisely the same; and whether the fracture was under the treatment of Hippocrates, of Paré, or of one of our own contemporaries, there must still have been the same exudation, cellular proliferation, formation of callus, and infiltration with lime salts, before the final restoration of bony union. But shall we hence assume that the average period of disability must be the same now, as in the past; and that in the future no more rapid return of function can be looked for than we secure at present? Is surgery to make no further progress?

The investigations of the Fracture Committee of the American Surgical Association, published in the *Transactions* for 1921, show that in this country, at present, the average period of disability for fractures of the femur is 8 months. How are we to reconcile this with a period of disability of 6 weeks only in the case of Charles XII? Is there any surgeon, in America, or elsewhere, who today can get his cases of fractured femur back to their work in an average period of 6 weeks? Certainly not. But Charles XII was a very exceptional patient: he had for years led the most strenuous outdoor existence, and his constitution was as hardy and his frame as robust as any known to history. He had all the reparative forces of the most healthy child; indeed, at the time of this accident he had not long passed his own adolescence. If we were to take the average period of disability of fractures of the femur in childhood, we should come much nearer the record set by this Madman of the North; yet even then very few patients could be discharged as fit for duty within 6 weeks.

It is true that age has a very great influence on the prognosis of fractures: a fracture in an infant often will be found firmly united within a day or so of the injury; one in a child up to 10 or 12 years of age probably will require only half the period for bony union that will be required in an adult. And it is after all bony union which is the first and most important thing to secure in a case of fracture. But bony union alone, without adequate function of the soft parts, will not suffice. Surgeons make a mistake, in patients of all ages and especially

in very young children, in regarding the bones as things separate and distinct from the soft parts: the bones were originally formed out of the soft parts, and the younger the patient the more intimate is the physiological connection between the two. The bones depend for their form largely on the action of the muscles, and in the daily use of the limb almost any deformity of the shaft of a long bone in a young child will be spontaneously corrected within 6 months or a year. Even a right-angled deformity of the femur in an infant, I have seen spontaneously corrected before the child was old enough to walk.

In adults, on the contrary, especially those whose bones serve merely as props to keep their limbs from collapsing, and whose muscles are of little physiological use to them, fractures are serious injuries, and unreduced deformities, even in the shafts of the long bones, are with difficulty compensated; while in fractures near to or involving joints, even in children, it is very important to secure as nearly anatomical reposition as is possible.

The more promptly reduction of the fragments is secured, the easier it will be to obtain anatomical reposition; especially is this true in joint fractures and in children. If attempts at reduction are delayed until swelling of the soft parts has reached its maximum, or until it begins to subside, they are not apt to be successful. And the mere fact that the broken bone has been restored to its normal form is very frequently enough to prevent injurious swelling of the soft parts from developing. For the soft parts also are damaged by the accident, and until their supporting framework is restored they can function but poorly if at all; and, as long as the fragments remain greatly displaced, swelling, circulatory stasis, and damage to the soft parts continually increase, until in many cases blood-filled bullæ and excoriations appear as mute witnesses of the neglect of the soft parts. In children, moreover, delay in reduction means early malunion; in adults frequently it means delayed union or non-union.

Then there is the difference, already indicated, between the prognosis of fractures of the shafts of the long bones and of those involving the joints. In the latter, anatomical reposition of the fragments is almost indispensable for good function; while in the former it is quite sufficient to secure that degree of reduction which will insure bony union with preservation of the normal axis, and without undue shortening. Although it was claimed by Velpeau that patients with shortening even up to 6 centimeters did not limp, no one now would be satisfied with such deformity; but we still recognize that function is more important than form, and that a deformity of the shaft, which requires the X-ray to reveal it, may well be ignored.

Of all the fractures of the shafts of the long bones, those of the tibia require the most accurate reduction. This is so because the leg is the only segment of a limb where the joints at both extremities of the bone are hinge joints. In the thigh and the upper arm, though the distal joint is a hinge joint, yet the proximal joint (hip, shoulder) is a ball and socket joint, and any slight axial rotation of the lower fragment persisting after union has occurred may be compensated by slight rotation of the proximal end of the limb. Even in the forearm the existence of the function of rotation in the radiohumeral joint serves largely to compensate for any rotatory deformity which may persist after union has occurred. But in the leg, where both the knee and ankle joints are accustomed to move in the same plane, any disturbance of this relation by axial rotation of one fragment on the other may entail very serious disability. And as the majority of fractures of the tibial shaft are

spiral, any appreciable shortening implies rotation of one fragment on the other. An anteroposterior angulation of the leg bones causes much less disability, because the ankle and knee joints will still have their axes of motion in the sagittal plane.

Let us endeavor, then, to improve the prognosis of fractures: (1) by securing as accurate reduction as is possible (even in shaft fractures) as soon as possible after the accident; (2) by recognizing and treating the accompanying lesions of the soft parts, accomplishing the latter purpose (3) by avoiding too long and too absolute immobilization, by use of such apparatus as will permit frequent carefully guided active movements whenever these latter will not dislocate the bony fragments; and (4) by caring for the skin surfaces by gentle frictions with cleansing lotions, by careful drying and powdering. Only in this way can we hope to prevent atrophy of the muscles and preserve the suppleness of the joints for the time when full function can be resumed.

ASTLEY P. C. ASHHURST.

THE SPLEEN

WHAT organ offers more field for research work than the spleen! Unique in the number of theories and hypotheses relative to its normal and abnormal states, it presents questions of intense, if not vital, interest. The important part it plays in certain disorders has become familiar, and, while its enlargement in various diseases of the blood is recognized, it certainly does not have to be enlarged in order to be the source of the patient's illness.

Great responsibility is placed upon the surgeon in interpreting the complex problems which arise. It is for him to answer why surgery did not produce so remarkable a result in this case of anæmia as in that one, or why less benefit was derived from the removal of the spleen in one case of cirrhosis of the liver than in another, with practically the same symptoms and an apparently equal chance for cure.

Formerly, surgical treatment was limited to the removal of an enlarged or injured organ, to one with a kinked pedicle, or an [illegible] doubt as to what step should be taken, but [illegible] been extended to anæmias, jaundice, cirrhosis of the liver, and similar conditions, the surgeon has much to consider.

The spleen is known to be non-essential to [illegible] yet why is it so closely connected with four of the body's most important [illegible] the hæmopoietic, the digestive, the sympathico-endocrine, and the reticulo-endothelial? It is supposed to have an intimate [illegible] iation with each of these systems. Why then, in its removal, is no irreparable loss suffered by any one of them?

In the embryo, it has been found to develop from mesodermal tissue, located near that which forms the framework of the liver as it grows from the foregut. It is believed to extract from the blood certain products which it turns over to the liver—not only waste material but substances which the liver must return to the body for the maintenance of health. This relation to the liver in action has been compared to the glomeruli and tubules of the kidneys. It has been termed the "scrapping plant" where the worn-out [illegible] re delivered, for the removal of whatever may be of no further service to the body. While not primarily involved in in- [illegible] from the circulation organisms which it can [illegible] stroy. Such focus in the spleen could bring about a destructive process in the liver.

We have long considered the spleen a blood-forming organ; it certainly is concerned in the formation of red cells during fœtal life.

If, as has been stated, the proportion of the portal blood derived from the normal spleen is about one-seventh of its total volume, consider for a moment the quantity that must pass through the splenic vein in an enlarged spleen. Is it any wonder, that in splenomegaly the liver is burdened, that, following splenectomy, the hepatic cells are greatly relieved?

We are aware of the spleen's relation to the digestive tract, because it increases the lymphocytes in the mucous membrane of the intestines, thereby exciting peristalsis; aids the liver in returning material for the blood; assists the pancreas—suggested by its anatomical features; participates in chemical composition, and in purin, fat, and iron metabolisms.

We feel certain that it possesses the function of offering resistance to systemic infections, that the evidences of its defensive properties are so strong they should not be lost sight of when considering surgery of this organ.

There seems to be no doubt that there is some interaction between the spleen and the endocrine glands. While we do not class it as one of the group of endocrines that has ever yielded an external secretion, we do believe it activates through the sympathetic nervous system and has something to do with at least the thyroid and the thymus.

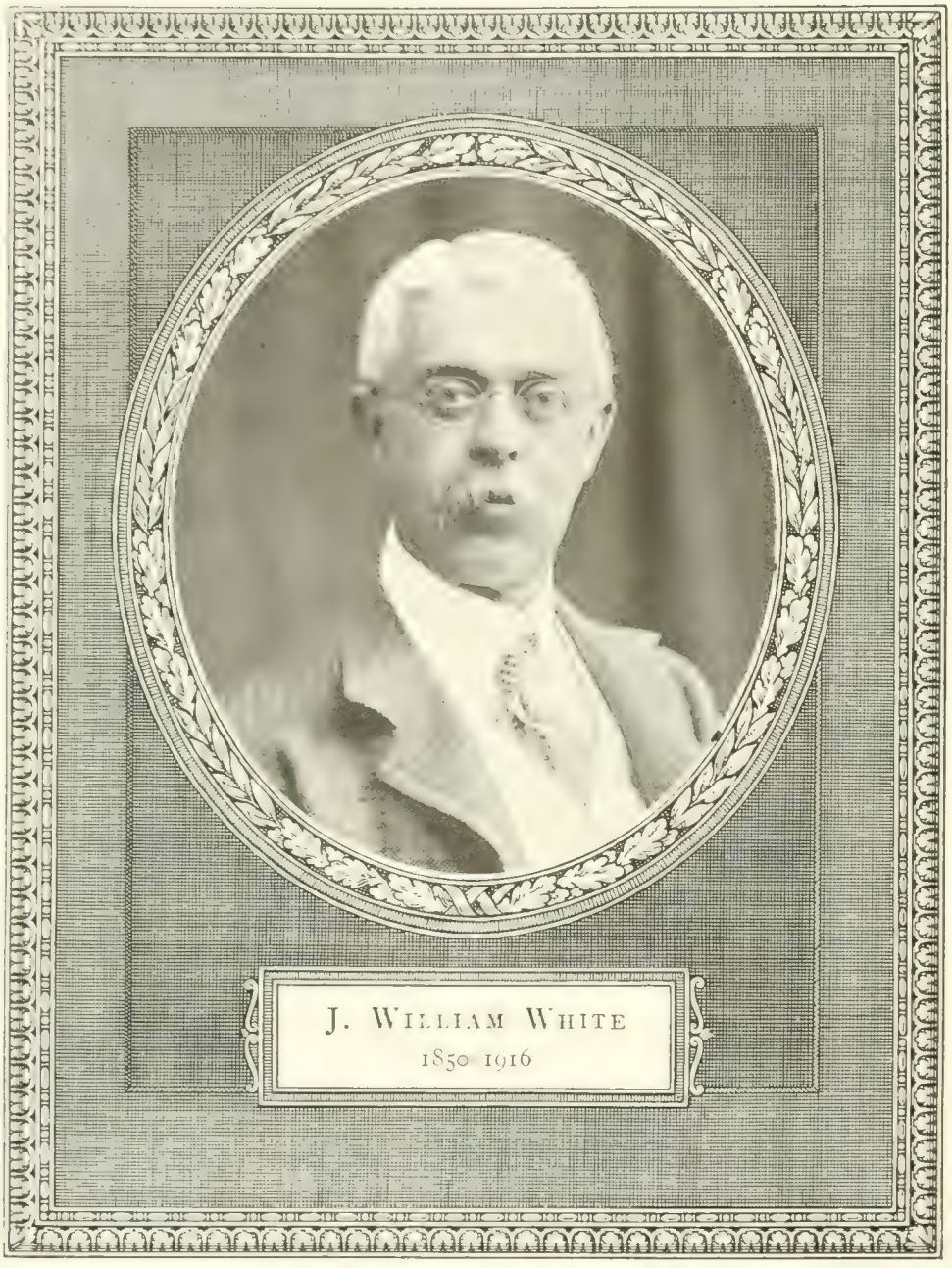
Research workers may make more clear the curious vascular position of the spleen; why its tortuous artery is so different from the other arteries; the significance of the attachment of its vein to the tributary veins; why all of its venous blood passes through the liver; how it can balance up the thyroid and why its removal may activate the thymus. Investigators may explain why, in its primary association with the lymphatic system, this organ is so unlike any other part of it.

The day has passed when we assume that a disease affecting an organ is necessarily restricted to that particular organ, and in the case of the spleen, with its intercommunications with the different organs by means of common veins, arteries, nerves, and connections, we believe it has a rôle in the etiology of diseases whose most prominent symptoms "may be evoked by the association of consecutive affections of other organs."

Instead of looking for a specific splenic disease, we are directing our attention to the functioning capacity of various organs likely to be concerned. May not symptoms point to the spleen even though it is normal in size? May not the focus be in the spleen, yet the clinical symptoms present a picture resulting from parts played by other organs in a process begun in the spleen? Splenectomy may remove the process and we may still find that all the other parts concerned will not return to normal. In other words, we are dealing with disorders of certain systems of the body which produce a morbid condition in an individual. What are we to do? Make an effort to discover the type of infection. When the lesion is discovered, ascertain if it causes poisons that produce hæmolysis, cirrhosis, jaundice, or some other condition. Seek the site of the lesion in the hæmopoietic, the digestive, the sympathico-endocrine, or the reticulo-endothelial systems.

While the spleen is regarded as not isolated but one of a group, connected with and influenced by the activities of other viscera, the future may lay bare its exact connection with these organs and clear up existing problems, many of which are centered in the splendid results following surgery in certain diseases and the less beneficial effects in others. We trust the time will come when the surgeon can explain why splenectomy does not always result in the expected cure, limited progress of a disease, or favorable influence on its course.

E. C. Moore.



J. William White

1850 1916

MASTER SURGEONS OF AMERICA

J. WILLIAM WHITE

J. WILLIAM WHITE, M.D., PH.D., LL.D. (Aberdeen), late emeritus professor of surgery, and trustee of the University of Pennsylvania, was born in Philadelphia, November 2, 1850, and died at his home in that city, April 24, 1916, after an illness of several months.

He was descended from the Reverend Henry White, who came from England in 1649 and settled in Virginia. Four later generations lived in North Carolina. James White of the fifth generation moved to Burlington, New Jersey. A son married Mary Stockton, a descendant of Richard Stockton, a signer of the Declaration of Independence. Dr. White's father came from this union. His mother was connected with the well-known New England families of Dowse, Hunt, Isbell, and Griswold.

Having attended the public schools and a private school in his native city, Dr. White entered the Medical Department of the University of Pennsylvania and graduated in 1871, and at the same time received the degree of doctor of philosophy, having taken the course leading to this degree simultaneously with his medical studies.

In the autumn of that year he accepted an invitation to join the scientific expedition headed by Professor Agassiz, sailing on the U. S. S. Hassler from Boston, December 4. The stops made included the West Indies, the Strait of Magellan, both coasts of South America, Juan Fernandez Islands, the Galapagos Archipelago, Panama, and Mexico; the expedition terminating at San Francisco in August, 1872.

On Dr. White's return to Philadelphia, he served as resident physician in the Philadelphia Hospital, and subsequently filled a similar position in the Eastern Penitentiary.

His connection with the University of Pennsylvania began in 1876, when he became an assistant on the surgical staff. Two years later he was appointed lecturer on venereal diseases and was placed in charge of this department of the out-patient service. In the early 80's he became assistant to Dr. D. Hayes Agnew, professor of surgery in the University of Pennsylvania, an association that continued with the greatest cordiality and satisfaction to both, until Dr. Agnew resigned on account of advancing years. In 1886 he was given the title

of clinical professor of genito urinary diseases. In 1880 he was elected to the chair of clinical surgery; and in 1900 was advanced to the position of professor of surgery.

In 1906, Dr. White received the degree of doctor of laws, from the University of Aberdeen on the occasion of the celebration of its four-hundreth anniversary, and was chosen as the spokesman to present the felicitations of all of the American universities.

His contributions to medical literature were frequent, and were conspicuous as examples of clear thinking and forceful presentation. He was joint translator and editor of *Cornil on Syphilis* (Simes & White), 1875; joint editor of the *American Text Book of Surgery* (Keen & White), 1890; joint author of *Genito-Urinary Surgery* (White & Martin), 1897; collaborator to Piersol's *Human Anatomy*, 1907, and to a number of other textbooks. Among his contributions to medical journals may be mentioned: "Hereditary Syphilis," "Dislocation of the Tendon of the Long Head of the Biceps Muscle," "Iodide of Potassium in Syphilis," "The Surgery of the Spine," "The Present Position of Antiseptic Surgery," "The Supposed Curative Effects of Operations *Per Se*," "The Modern Treatment of Vesical Calculus in Male Children," "The Treatment of Glandular Tumors of the Neck," "Tumors of the Female Breast," "The Abortive Treatment of Syphilis," "The Topical Treatment of Focal Epilepsy," "The Roentgen-Rays in Surgery," "The Surgery of the Hypertrophied Prostate," "The Treatment of Delayed Union and Ununited Fracture," "The Diagnosis and Treatment of Appendicitis," "The Value of Early Operations in New Growths," "The Surgical Affections of the Kidneys," etc., and also a memoir of Dr. D. Hayes Agnew, and numerous addresses.

Although Dr. White resigned the professorship of surgery in the University of Pennsylvania on January 1, 1911, and retired from practice, his activities were not diminished, but were turned in other directions. He was made emeritus professor of surgery, and elected to the board of trustees of the University, in which position he served his Alma Mater with untiring zeal until his death.

In the board of managers of the University Hospital, of which he was a member, and in the athletic association of the University, he exercised a dominating influence. He was equally active as a member of the board of commissioners of Fairmount Park, of the board of managers of a large saving fund society, and in many other useful public movements.

Dr. White was endowed with unusual vitality and an inexhaustible energy. He was deeply interested in physical education and inaugurated this department in the University of Pennsylvania in 1884, becoming the first professor of this subject. He was also an ardent advocate of out-of-door exercises. In his earlier years he was a very active and enthusiastic devotee of sparring, swimming, rowing, steeplechasing, and bicycling. In his more mature years he found an outlet

for his energy in [illegible] mountain-climbing, [illegible] Swiss and American Alpine Clubs. However, he never allowed these diversions to interfere with a faithful attention to his patients, or to his hospital or teaching duties.

In the faculty of the Medical School of the University of Pennsylvania, Dr. White was a source of great strength. His teaching was noted for its soundness, clearness, and force. He held the interest and attention of his [illegible] to an unusual degree, and enjoyed in the largest measure the confidence and respect of the students. His keen and discriminating judgment was recognized by his colleagues and by the students, both of whom constantly sought his advice and counsel.

Although busily occupied in his profession, he gave freely of his time to public affairs. His overflowing energy and his powerful influence were always employed as constructive forces. He never criticized unless he had an alternative to offer that he considered an improvement. He did not pull down, except for the purpose of building a better structure. Uncompromising as an enemy, he was the staunchest and most loyal of friends, not one of whom, it may safely be said, ever appealed to him for help in vain.

When the World War broke out in 1914, Dr. White's interest in the cause of the Allies was at once aroused.

As Dr. White's biographer truly says, "Individual neutrality was to Dr. White a form of mental and moral cowardice. He held that no rational being has a right to plead ignorance, when knowledge is attainable, or to be indifferent to matters of right and wrong." In an effort to obtain knowledge in this matter, he at once began scanning the very voluminous literature put out by the warring nations, as well as that from other sources, that appeared to be reliable. The conflicting statements observed in this study seemed to be covered by twelve fundamental questions which he set down and proceeded to answer in order that he might himself reach reasonable conclusions. Those who had the privilege of reading this manuscript, urged Dr. White to publish the material in order that it might have a wider reading. This he did in December, 1914, under the title of *A Primer of the War for Americans*. So concisely and so authoritatively was the subject covered that the demand speedily exhausted three editions, and it was also translated in a number of foreign languages.

This was followed by *Germany and Democracy*, and later by a *Text Book of the War for Americans*, a volume of 500 pages, which appeared in May, 1915.

In this volume he included the matter contained in the pamphlet, and added such other important information as had accumulated in the interval between the two publications. This reference would scarcely be complete without adding that the proceeds of the sale of the pamphlet were given to the Belgium Relief Fund.

The final act of Dr. White's busy life was the organization of the University of Pennsylvania Unit of the American Ambulance Hospital, in Paris, which he accompanied to its post of duty in June, 1915, and he personally raised the money necessary to equip and transport the unit. It was during this trip that the first sign appeared of what proved to be a fatal illness.

A successful practitioner of surgery, an impressive writer, a teacher of the first rank, a public spirited citizen, filling many posts of responsibility and of honor, a wise counselor to a host of friends who depended on him in all emergencies, Dr. White exerted an influence in his community such as is rarely commanded by a single individual.

ALFRED C. WOOD.

CORRESPONDENCE

CHRONIC INTUSSUSCEPTION IN AN ADULT; DURATION FOUR MONTHS. RESECTION. RECOVERY

To the Editor: The patient, a poorly nourished Turkish peasant woman of about [illegible], was seen by me on May [illegible], 1909, [illegible] ished and [illegible] As usual with this class of pea[illegible] to obtain a very definite history.

Her chief complaint was severe abdominal pain, occurring without definite relation to meals, and persistent constipation. [illegible] 4 months previous. [illegible] a well developed [illegible] woman of about 25. The scalp [illegible] mouth were negative [illegible] tongue. There was no enlargement of thyroid or cervical glands. Pulmonary resonance and breath sounds were normal. The heart was [illegible] sounds were normal. The [illegible] distended, tympanitic, with moderate diffuse tenderness. Palpation set up violent peristalsis, which was painful, [illegible] domen being thrown into marked folds and ridges. There was no localized [illegible] liver and spleen not palpable. [illegible]

Patient was admitted to the Varnali Smith Memorial Hospital, Aintab, on May 31, with a preliminary diagnosis of chronic intestinal obstruction. As 5 days' treatment with cathartics and enemata failed to reduce the distention materially or [illegible] the pain, exploratory operation was decided upon.

Operation June [illegible]. [illegible] through a median incision, which was later extended from the umbilicus to the symphysis pubis. The cause of the obstruction was found to be an intussusception, ileocæcal, with a tumor mass in the [illegible] about 6 centimeters in diameter. The ileum above the neck of the intussusception was moderately dilated and greatly thickened. Strands of firm white fibrin protruded from the neck. No attempt was made at reduction. The cæcum was mobilized and the mesenteric [illegible] ligature and freed from the gut for a distance of 3 centimeters above the neck. [illegible] thus isolated was resected and the free ends of ileum and ascending colon inverted, after which an [illegible] mosis was made, side to side. The abdomen [illegible] closed layer by layer with plain and chromic catgut and black silk. The operation lasted 2 hours, and during a large part of the time several feet of ileum remained outside the abdomen.

Postoperative course. Immediately after operation the patient received 500 cubic centimeters of saline [illegible] of the protracted evisceration during the [illegible] was controlled with lysis. She was also troubled by a certain amount of diarrhœa, which was quite easily controlled with belladonna and opium. The patient left the hospital on the thirty-third day after operation, free from fever and without complaint.

[illegible] *men.* The specimen consists of [illegible] junction, with vermiform appendix [illegible] the neck of the intussusception project several [illegible] annular tumor mass with a lumen [illegible] the center 0.5 centimeter in diameter. The distal portion of this tumor is gangrenous and sloughing [illegible] uniform resistance to the knife, and shows a faintly fibroid uniform appearance. The outer surface of the intussusception shows many strands of [illegible] ileum involved about 30 centimeters.

[illegible] Chronic intussusception. [illegible] of small intestine

The chief points of interest in this [illegible] complete obstruction, possibly to be explained by the [illegible] complete closure of the lumen at the apex.

[illegible] established after operation [illegible] period of extensive evisceration. I have thought this might be attributed to the great hypertrophy of the muscular wall of the ileum above the [illegible]

[illegible] A. SHEPARD, M.D.

[illegible]

TRANSACTIONS OF SOCIETIES

CHICAGO GYNECOLOGICAL SOCIETY

REGULAR MEETING, HELD FRIDAY, FEBRUARY 17, 1911. DR. CARLY CULBERTSON, PRESIDING.

THE DIAGNOSTIC AND CLINICAL ASPECTS OF GONORRHOEAL SALPINGITIS

DR. HENRY SCHMITZ read a paper entitled: "The Diagnostic and Clinical Aspects of Gonorrhœal Salpingitis." (See p. 627.)

DISCUSSION

DR. CHANNING W. BARRETT: The essayist has given us a very distinct clinical picture of the gonococcus in the pelvis. It is scarcely ever that we have a discussion on the subject of infection without some person wandering away from the infection and discussing the reaction as the harmful thing. For instance, we hear it repeatedly said that if such and such a thing is not done or is done the endometritis will extend to be a salpingitis, and the salpingitis will extend to be a peritonitis, and a local peritonitis may extend to be a general peritonitis. There is no such thing as these extending of themselves. Their very nature is a limiting process. It has been said that the tendency is toward recovery. Yes, the process that is going on in the tube, the reaction against the infection, is a process tending toward recovery, but often times so much damage is done that complete recovery cannot take place. Nowhere in the body, perhaps, is the protective nature so well shown as in the lengthening of the tube, the turning in of the tube, the thickening of the wall, the round cell infiltration, and the leucocytosis of the tube.

Then the question will arise, do we not very much overdo operative treatment, because we are repeatedly operating for inflammatory processes in the tubes. It is very evident in many of the protective processes that the primary nature of the process is protective, and yet with that process going on damage has taken place that will require a cleaning away of débris, and so we have the process to deal with both in the pelvis and in the tubes.

I would agree with all the essayist has said in regard to the diagnosis. I think it very frequently falls to our lot to make a probable diagnosis of gonococcus infection without any of these helps mentioned, without being able to make a smear showing the gonococcus, without being able to make a culture showing the gonococcus, without getting reactions, and yet we feel certain that there has been a gonococcus infection. For instance, when a young woman, perfectly well up to the time of marriage, menstruates the next day after marriage, and following that menstruation she develops a pelvic inflammation, we feel certain she has had a gonococcic infection, especially if she later develops extra uterine pregnancy on one side, or a well-developed pus tube. Such things do not occur without gonococcic infection.

The history of these infections, as related by the essayist, reminds one of the discussion of Noeggerath which is found in the literature, in which he taught that a woman with these pelvic infections had a gonorrhœal husband; and well-known men in America in discussing the paper said that was not true; that it was not at all probable, but if there was any truth in it at all, it should not be allowed to become common knowledge because it would be the means of causing a great deal of disturbance among families. The thing they did not think at that time should be discussed in a medical society is discussed now very freely in the newspapers and in women's home journals. It should be known, of course. Women should know. A young man should know that to be indiscreet in his habits is going to lead to disease which is not going to be easily cured. When the wife becomes infected by the husband, in many cases the cure is not easily effected by the gynecologist, who knows that a great many of these cases are not easily cured, if cured at all. Many a man thinks he is cured of a gonococcic infection, and yet when he marries, his wife during the first year develops infection, a slow or perhaps more rapid reaction, and possibly the reaction is not great enough to keep her from having one child, but such a severe reaction may take place that she does not have another.

We have these infections in all their forms at the Cook County Hospital. We have patients coming in there with a history of infection dating back only a few days, and in some of these cases we are unable to find a mass in the pelvis. Once in a while we find one of them without a mass in the pelvis, although gonorrhœal infection is very evident from infection of Bartholin's glands, a violent urethritis, the discharge found in the cervix, and by the evidence of painful adnexa. There is no doubt of a gonococcic infection, and yet we may be inclined to think that patient may get along without an operation. We allow such a patient to go home sometimes with the injunction to return if she has a return of her trouble or it takes on renewed activity. Most of those pati-

ents sooner or later [illegible] noticeably enlarged. [illegible] is evidence of [illegible] history would indicate. We have those cases which show no [illegible] masses may involve the bladder, the broad ligaments, the sigmoid, the cæcum, the appendix, the ureters, [illegible] these viscera [illegible].

The operative procedure we would carry out in all cases where the [illegible] least, the removal of the tubes. In any period of my practice in dealing [illegible] the gonococcus I myself have not had any satisfaction from [illegible] have left any portion of the tube, I have had no results from the standpoint of childbirth, and usually these tubes have given trouble afterward. It goes without saying that [illegible] is not good practice. The tubes should be removed down into the uterus. I do not know that we can lay much stress upon absolutely leaving some portion of the tube in [illegible] cases the infection is so great that the ovaries are markedly involved and are mere shells filled with pus and necrotic [illegible]. Yet I would lay great stress on the advisability of leaving an ovary if it is in condition to be left, and we should endeavor to leave [illegible] condition. I would rather leave [illegible] uterus when it is in condition to be left, but in some cases the damage done is so great that it is not at all advisable to do so. I should not lay any great stress on leaving the cervix from the standpoint of giving a better vault for support because the structures do not get their support from the cervix; they get their support from the ligaments, and the [illegible] be utilized to hold up the vagina [illegible] they can be utilized to hold up the cervix.

There are those who [illegible] days of pus tubes not needing operative procedure. I find in my experience with these cases in hospital and in private work, more particularly in the class of cases we have to deal with [illegible], very little to give me encouragement that we can ever get along without the removal of the tubes. These patients are sick and sick until they have their tubes removed, and sometimes the removal of more important structures [illegible]. I never hold out any great assurance that we are going to get 100 per cent good results after operative procedure in these cases. As I have said, a lot of damage has been done, and a patient may have anything from a binding down of viscera to absolute obstruction of the bowels following such conditions, and yet we know a large percentage of cases are greatly improved and some of them cured by [illegible] measures.

Dr. Curtis: Have you tried isolating these patients from the sources of infection, getting them away from their husbands or from those from whom they acquired the disease?

[illegible] it. I have seen pat[illegible] a until the[illegible] their husbands, and then their[illegible] and they got fairly [illegible]

Dr. Arthur H[illegible] douches in the production of tubal infection. We [illegible] all for[illegible]

[illegible] study of salpingi[illegible] almost [illegible] attacks of salpingitis. A single attack of salpingitis [illegible] who have been prostitutes or those subjected to [illegible] greatly thickened chr[illegible]

If a patient has only had one attack of salpingitis [illegible] we may ordinarily feel assured of a mild course, with the possibility of bearing children at a later [illegible] It is reinfection from [illegible] infected lower genital tract, which tends to make the disease in these patients chronic with marked [illegible]

Dr. Barrett: I have noticed in cases in [illegible] much damage was done in the uterine portion of the tube that it became the size of a hickory nut or a walnut. I have noticed this particularly in w[illegible] may not be involved very much, but there [illegible] reaction in that part of the tube.

Dr. Curtis (resuming): Studies have been made [illegible] the presence [illegible] versally accepted that the gonococcus does not live [illegible] as far as I know, until recent times, cultures [illegible] entire tubes have not been examined for the presence [illegible]. We [illegible] removed from patients with chronic salpingitis with [illegible] pus present, and were unable to find the [illegible] in any patient who had been without fever or leuco[illegible] that there is no such thi[illegible]

infection of the tubes from some external or infection after a short time.

J. Warren Vaginal incision and drainage for infected fallopian tubes is usually not good treatment. With palliative treatment a good and lasting immunity will occur. Vaginal incision and drainage in such cases is always an incomplete operation, as there are multiple pockets of pus and all of them will not be incised and drained. Incision and drainage will generally be followed by a secondary infection and the result is a septic sinus which would require abdominal section. There are, however, exceptional cases where incision and drainage is good treatment. It seems to me that Dr. Schmidt's position relative to not disturbing the nerve and blood supply of the ovaries and his position in grafting ovaries are inconsistent, as in one case he is careful not to disturb the blood supply and in the other he entirely cuts off the blood supply. It has seemed to me that if there is any ovarian tissue sufficiently normal to be grafted, it is healthy enough to be left in situ. No one would question the fact that an ovary left *in situ* offers better opportunity for function than one that is transplanted. There is a strong suspicion that fragments of ovaries which have been left, in separation of adhesions and the like, have sustained menstruation in cases where the credit has been attributed to transplanted ovarian tissue.

I can see no excuse for complete hysterectomy in these cases, except in very exceptional instances. The cervical mucosa can be reamed out if necessary. The preservation of much of the broad ligaments intact is of much value to the pelvic floor.

Estimation of cures of gonorrhœa based upon microscopic examination of smears is of very little value except in acute cases. In the chronic cases gonococci will not be found in either instance.

Experience dictates that the most important palliative treatment is rest.

In my private practice gonorrhœal pus tubes have become extremely uncommon. I do not remember having operated upon one in the last year or two. The patients one sees in private practice are very different from those encountered in the County Hospital, the County cases having much more complicated and extensive pathology.

I have reported two cases of undoubted gonorrhœal infection of the tubes, where upon subsequent abdominal section the fallopian tubes appeared entirely normal. This justifies the statement that spontaneous recovery of gonorrhœal infected tubes occasionally occurs. Consequently, I believe that all cases should be given an opportunity to recover without operation, and that operation should be done only when positive indications dictate.

Dr. Irving F. Stein: With regard to the question of diagnosis of cases of recurrent attacks at some time distant from the initial inflammatory attack, I have in mind a group of cases that were extremely difficult to diagnose because of the atypical symptoms and physical findings, and which were only properly diagnosed in some instances on the table, and in others only when the pathological report was received. In this connection I want to report two cases. One was a married woman, 27 years of age. Six years before her marriage she was living a rather loose life, and came to me on November 21, complaining of a severe pelvic pain on the left side associated with irregular bleeding, with the passage of clots, occasionally with dizziness and faintness. She had sensitiveness of the breasts, frequent urination without pain or burning. Her last regular menstrual period was 2 months before, and the bleeding since that time was scant, was scarcely more than spotting and associated with severe pelvic pain. The spots were bright red and often with clots. Three and a half years ago she was operated upon for ectopic pregnancy. She had never missed a period from the time of the operation until the present time, when she missed 2 months. At the time she presented herself she said she felt the same type of pain as she had with her ectopic pregnancy. She had dizzy spells, fainting spells, and spotting. There was no history of any acute inflammatory process, except in the convalescence from operation, which was rather protracted and febrile; she was in the hospital over 3 weeks after her ectopic pregnancy. At the time of the examination there were no color changes in the mucous membrane suggestive of pregnancy, but her uterus was slightly larger and softer than normal and somewhat irregular. She had tenderness on both sides but no mass was palpable. There was no bleeding at the time she presented herself. She was told to keep in touch with me so as to be under observation. On December 5, 2 weeks later, she returned for examination; she again emphasized the point that she was very fearful of another ectopic. During almost a month she had been having repeated attacks of pain with spotting and fainting. At this time I advised her to go into the hospital for examination under an anæsthetic, which she did, and under the anæsthetic nothing was palpable in the adnexa, and the uterus seemed a little enlarged, soft, and slightly irregular. There was no bleeding at the time, and I again sent her home in order that she might be kept under observation. Three days later, at 2 a.m. she was bleeding rather profusely with clots; she had severe pelvic pain in the right lower abdomen, and had vomited at the onset and felt very faint. At this time her temperature was 99°, pulse 108. She was sent to the hospital, and on admission her temperature was 99.4°; hæmoglobin, 75 per cent; white count, 14,500. Laparotomy disclosed the pelvis full of adhesions, the omentum plastered over the uterus, the left adnexa missing; right tube was enlarged to about the size of the index finger and closed, club-shaped, black in color, very soft and found to contain clots. Upon opening the tube a blood clot was found but there was no evidence of any ectopic pregnancy.

The pathological report of this case was as follows: tube contained a quantity of clotted blood, but no

cytes; vessels [illegible] catarrhal salpingitis. This patient was without fever, and the attack simulated the picture of a typical ectopic. [illegible] home on the [illegible]

The other patient [illegible] whom I saw [illegible] or less continuous bleeding [illegible] married 8 years ago. [illegible] there was no history of pregnancy. [illegible] carried to 6 months. After being examined by a woman physician she began to bleed and the membranes ruptured. The first time I saw her was at the Michael Reese Hospital, when she was in labor, and I delivered her in [illegible] after the rupture of the membranes. She had an afebrile puerperium, having [illegible] acute pelvic peritonitis, was treated conservatively in the [illegible] weeks' time [illegible] observation. At that time her hæmoglobin was 70 per cent; white count 12,000. The diagnosis on discharge from the hospital, made by Dr. Lackner, was parametritis, with marked infiltration on the left side. She had [illegible] time [illegible] that time she was singing and dancing in cabarets. She had very little sensitiveness and no history of pain. She had regular menstruation until 2 weeks before she [illegible] more or less continuous bleeding. At the time she had a retroverted uterus, bound down, without any possible [illegible] tinued to [illegible] 30, she had a convulsion at 8 o'clock in the morning. She was [illegible] it was found [illegible] count, [illegible] 121°, pulse [illegible] decided [illegible] cavity was found free of blood; the tubes and all the pelvic structures were extremely pale; the tubes bound down in the typical manner described by Schmitz for the gonorrhœal type of inflammation by very tough [illegible] larged to about the [illegible] and were closed. [illegible] tial oophorectomy was done, with excision of the tubes from the cornua. The pathological diagnosis was bilateral interstitial salpingitis, unilateral chronic purulent salpingitis, bilateral chronic adhesive salpingo-oophoritis and cystic corpus luteum of the ovary.

My reason for detailing these two cases is that we find in cases of [illegible] gonorrhœal tube probably are infection of gonorrhœa, but with a clinical picture that is distinctly atypical.

by Dr. S[illegible] found it in [illegible]

[illegible] in the [illegible] other hand, the majority of cases wherein the Bartholin glands are [illegible] vault.

[illegible] subacute stages is without [illegible] tant thing, and th[illegible] sion.

[illegible] referred to, bilateral [illegible] ovarian [illegible]

[illegible] rly or [illegible] think such drainage is of much value. I drain these [illegible] patient of the immediate suffering from pressure and [illegible] I do not think it makes much [illegible]

[illegible] entire uterus. Where the uterus is definitely pathological [illegible] be removed. I am not afraid of taking the [illegible]

[illegible] of shortening the vagina, since where the round ligaments are stitched into the vaginal vault [illegible]. On the other hand, I agree with Dr. Watkins that the pelvic floor is somewhat weakened by the removal of the cervix.

RADIUM VERSUS OPERATIVE TREATMENT OF FIBROIDS

Dr. Heaney discussed the clinical results of radium and operative treatment of fibroids. (See p. [illegible])

DISCUSSION

Dr. Joseph L. Baer: I am sorry the essayist did not go into the systemic disturbances following either operation or the use of radium and X-ray. I should have been interested in what his conclusions were regarding that phase of the subject, since so much attention is being paid to endocrine activities in all fields.

In reading the literature and in observing both the operative procedures and the X-ray and radium treatment at the Michael Reese Hospital, certain effects on the system have stood out in my mind, more particularly the psychic equilibrium of the patient. It seems to me, there is a definite consensus of opinion that the psychic equilibrium of the patient is much less disturbed following some form of radiation than following operative interference. Whether the explanation is the consciousness of mutilation on part of the patient, or an actual surgical trauma of the genital nerves, I do not know. Secondly, the sexual function and libido of the patient are much less disturbed following radiation than following surgical interference.

Dr. Schmitz: Do you mean radium or X-ray?

Dr. Baer: Either. In the third place adiposity seems to be more noticeable following operative intervention than following radiation.

Dr. Heaney: Are you comparing the removal of the ovaries with radiation?

Dr. Baer: Yes. The only systemic effect that seems to act indifferently, according to both methods of treatment and according to the literature, is the occurrence of flashes and hyperidrosis. The results seem about fifty-fifty in these two phenomena.

One very interesting disadvantage of the X-ray which I personally have never observed but which is described repeatedly is a loss of memory either temporarily or permanently. I should be interested if Dr. Heaney has any remarks along the line of systemic disturbances.

Dr. Henry Schmitz: I wish to mention the contra-indications we have followed in our work. In the first place, if a fibroid is complicated with any other pathology, it is not subjected to radiation. In the second place, if a fibroid does not cause any symptom, it does not indicate any treatment at all. In the third place, fibroids which cause pressure symptoms or degenerative changes, are never treated by radiations. In the fourth place, cervical, submucous and subserous fibroids are never subjected to radiation. A subserous fibroid does not cause one of the symptoms for which we treat these patients, that is, hæmorrhage; while submucous fibroids are accompanied by marked changes in the endometrium, and in these the use of radium is contra-indicated. Fibroids which are larger than a man's fist and situated mid-way under the symphysis pubis and umbilicus are not subjected to radium. This means that there are only a few cases left which are strictly intramural and of small size that are suitable for radium treatment. I find in my work that fully 40 per cent of fibroids are susceptible to radiation and can be treated with success.

The question arises whether we shall treat these patients with radium or X-ray. By that I mean to say, is there any advantage in using one or the other? It has been my firm conviction, and I have substantiated this by microscopic examination of ovaries which have been removed from patients previously treated with radium, that the ovary shows hardly any reaction at all from the radiation. On the other hand, the radium radiation is entirely spent on the endometrium and the substance of the uterus alone, while the X-ray application necessarily attempts to bring about the cessation of ovulation or, in other words, a premature menopause. In the other 60 per cent of cases, hysterectomy or myomectomy is done as indicated. There is no doubt that operative procedures are very safe, especially if we operate on a class of patients who are intelligent and can take care of themselves afterward. One should take into consideration the ease with which a patient recovers from radium treatment and the difficulty at times of recovering from an operation. We prefer radiation where it is indicated.

The tabulation of the results of the work of Dr. Heaney is certainly very elaborate and minute and is very interesting, and I congratulate Dr. Heaney on his success in this work.

Dr. Heaney: Dr. Schmitz mentioned that histologic examination of the ovaries after radiation with radium showed very little change. The proof of the effect of the action on the ovaries would not have to depend upon microscopic examination when we have definite hot and cold flashes. The patient does not menstruate, and if she has hot and cold flashes her ovaries are disturbed whether the microscope shows it or not.

Dr. Schmitz: Are these disturbances less frequently seen under radium radiations than under X-ray radiations?

Dr. Heaney (closing): So far as the psychic effect is concerned between radium and operation, I should say the degree of psychic disturbance is a hard thing to measure. If a patient does not menstruate and has hot and cold flashes, those are the best indices as to whether a patient is having cessation of ovarian function or not. The disturbances are just as severe in a patient who has had her ovaries removed as they are when radiation is resorted to. There is no difference except sometimes a patient

rhœa, it is delayed. But in operating these patients are liable to get well more quickly than with radiation.

So far as loss of memory and psychic disturbances are concerned after radiation, I think one patient I have in mind got psychic disturbances rather than physiological results of the operation because psychic disturbances occur anyway in patients of such temperament. The psychic disturbances may be [illegible] go to California, or because she could not get an automobile, or by any psychic jar, and it is not due to radium in one case and to operation in the other. In this patient, who had a temperature of 105° and who was very sick for 5 days, with great care I removed enough of the uterus so that menstruation would continue. That patient was 38 years of age. She had a fibroid well above the umbilicus which protruded like an advanced pregnancy. She wanted to get married and wanted to know the results [illegible] While she is not exactly crazy, she is very [illegible]

In regard to [illegible] children. If I [illegible] sive fibroid tumor on which [illegible] and is afraid [illegible] ould not h[illegible] given [illegible] patients is [illegible] should attac[illegible] pital bills sometimes will count for much.

CHICAGO GYNECOLOGICAL SOCIETY

Regular Meeting, Held March 13, 1911, [illegible] W. C. Danforth, President.

ROUND-CELL SARCOMA OF PUBES AND ANTERIOR FORNIX IN BABE OF SEVEN MONTHS: CARCINOMA OF BREAST IN PATIENT OF TWENTY-ONE

Dr. Mark T. Goldstine: The mother of a 7 months old girl [illegible] brought to the child because the [illegible] growth protruding slightly from the vagina. When I saw the child the growth was about 1.5 inches long and 0.75 inch thick, to the right of the urethra, pushing the [illegible] membrane over the top was very thin. On handling, the growth seemed hard and fairly firm. It did not bleed easily when touched. The tumor apparently had grown rather rapidly in a month, for the mother had noticed it first when the child [illegible] months old. From the previous history and [illegible] seeing similar cases abroad, I made a diagnosis of sarcoma and advised the removal of the growth with subsequent radium treatment. I operated upon the child and found removal of the growth rather tedious [illegible] area along the ramus of the pubes. I did not find [illegible] from the pubes and the anterior rim [illegible] The microscope confirmed the diagnosis of round-cell sarcoma. I introduced 100 milligrams [illegible] result will be remain[illegible] urse, is bad.

[illegible] girl of 21, married for 3 months, who had noticed [illegible] to my seeing her. As is my custom in all breast [illegible] the nodule came out easily, whether a [illegible] radical operation, th[illegible] a more ad[illegible]

CHICAGO GYNECOLOGICAL SOCIETY

REGULAR MEETING HELD APRIL [illegible], 1909. DR. W. C. DANFORTH, PRESIDING.

TECHNIQUE IN CYSTS AND ABSCESSES OF BARTHOLIN'S GLANDS; TECHNIQUE IN PROLAPSE OF FEMALE URETHRAL MUCOUS MEMBRANE

DR. THOMAS J. WATKINS: Operations for these conditions are made much easier by making a free longitudinal incision through the vaginal surface for the entire length of the cyst. The sac is then everted [illegible] everts a sebaceous cyst after incising it. The lining of the cyst is then either enucleated by blunt dissection or denuded in strips. The advantages of this procedure over the usual method of [illegible] much time is saved, much less bleeding occurs, less traumatism results, and less swelling and pain follows.

The note on technique described below is for use in the peculiar type of prolapse of the mucous membrane, which is similar in form to prolapse of the rectal mucous membrane. The feature in technique consists in making a longitudinal incision through the vaginal mucous membrane an inch or more in length down to the urethral body. The urethral body is now rendered mobile by increased dissection, if necessary, to an extent of allowing the prolapsed membrane to be easily replaced by grasping the urethral body by a tissue forcep. The urethral body is now fixed by careful suturing. This procedure has all the advantages of the Emmet operation and the additional advantage that a urethral fistula is avoided.

SO-CALLED CATGUT INFECTIONS

DR. JOSEPH B. DELEE: Every little while one hears of some hospital having a run of catgut infections, or one is surprised at a good, clean case suppurating or developing a more or less serious form of infection. I have always felt our little errors of technique were responsible for the so-called catgut infections, and also sometimes for the graver forms of infection.

For many years I have thought we trusted too much to one or two layers of sheeting to protect the sterile field from contamination, so in order to prove the point I have had a piece of ordinary operating gown magnified 950 diameters and have pasted thereon some photomicrographs of pure cultures of four of the most common infective agents. We have seen many times after a dusty, non-sterile table is bedecked with a sheet that table handled with confidence; we have seen the operator put his sterile gloves under his arms; help to lift the patient (through a sterile sheet), the instruments are handled with one layer of towel between the non-sterile fingers and instrument, trusting one layer of cloth to delimit the infection. We have seen sterile instruments and catgut laid on a table protected (?) with one or two layers of towel. Sometimes a sharp needle will go through the cloth to the table underneath. If the cloth is wet capillarity will draw the germs through.

I have had this cloth made which magnified a piece of surgeon's operating gown 950 diameters, and here we have photomicrographs of various bacteria. I dare say that I was surprised myself when I saw this chart is putting it mildly. These photomicrographs were made by Mr. Frank Harmon, so that you can rely on their accuracy. The piece of surgeon's operating gown was new and was magnified 950 diameters. Here (demonstrating) is a culture of the staphylococcus albus. There are here several thousand staphylococci. Here is a culture of the tetanus bacillus. There are 60 or 70 in this colony. You also see here colon bacilli and streptococci. There is room for several hundred thousands of these bacteria to march abreast between the openings of the fibers of this gown. The thickness of the gown is about one-half the size shown, so that you see the distance the bacteria have to travel from the infective surface to the sterile field is a considerable one for germs to travel. But, when we remember there are air currents constantly going through these interstices of the fibers, and how these clothes are rubbed over the dusty surfaces, it is easy, under such circumstances, to see how contamination occurs. We know that a rubber glove does not always protect the hand from the odor acquired from examining a cancer, and occasionally after the use of lysol the hand will smell of lysol even if there is no perforation in the glove. I will have Mr. Harmon take a glove and see if there are any openings in it. Some years ago this question arose, and I took a sterile glove and put a culture bacillus pyocyaneous in it and inserted the glove in sterile bouillon, and there was no growth, so that we proved these bacteria do not go through the rubber glove.

DR. WATKINS: I would like to ask Dr. DeLee what the plan was of making these photomicrographs.

DR. DELEE: The photomicrograph of the cloth was made by Mr. Harmon and he magnified it about 90 times. He makes photomicrographs of silks and other materials. I simply took the photograph which he supplied me to a photographer and told him to magnify it 10 diameters which brought it up to the size you see, namely about 950 diameters, and the bacteria were also magnified 950 times. I believe what I have shown will explain many of the cases of occult infections that arise in hospitals.

DR. W. A. NEWMAN DORLAND read a paper entitled "The Youngest Tubal Pregnancy to Date."

PROBABLE TUBAL PREGNANCY

Dr. Carey C[illegible]: Without detracting this very interesting and valuable report of Dr. Dorland's, I wish merely to show 2 specimens which I recovered at my clinic at the Cook County Hospital this morning.

The specimen is that of a right fallopian tube somewhat kinked and thickened but with a patent abdominal ostium. About 0.5 centimeter from its uterine end is a small [illegible] which closely suggests an ectopic pregnancy. The patient was a young woman who [illegible] ago had a spontaneous abortion at [illegible] This passed uneventfully without subsequent [illegible] She has been [illegible] She has menstruated every 30 days for 5 days each time, moderately without [illegible] She came to the hospital complaining of pain in the lower abdomen that had been going on for [illegible] and with heavy bearing down sensations, with pressure in the lumbosacral region. There have been no acute attacks of pain which required her to go to bed, associated with nausea and vomiting or with chills and fever. She has had no sharp, colic like pains at any time. Her last period began the 10th of last March. She [illegible] therefrom or the 15th of this month [illegible] not. When I examined her yesterday for the first time, I found the uterus in retroflexion, and while it did not appear to be fixed, yet it was not [illegible] as a simple retroflexed uterus should be. The appendages were prolapsed. Owing to the fact that she has missed something like [illegible] and had been regular, I hesitated about ordering her up for operation. However, I had her brought up prepared for operation with the intention of examining her first under gas anæsthesia. This was done. The uterus appeared to be very freely [illegible] again under anæsthesia I was unable to elevate it. Having in mind that it [illegible] there were probably kinked tubes, and that we might have an early ectopic pregnancy, I decided to operate. The uterus was adherent in retroflexion by dense old bands, the appendages were prolapsed and the tubes kinked and thickened but patent. The left tube was fairly normal when freed but the right contained the small [illegible] I have mentioned. The left ovary contains a corpus luteum 1.5 centimeters in diameter; the right ovary was quite normal. The uterus was soft and enlarged, about as an early pregnant one should be. Its [illegible] After breaking up the adhesions the right tube was [illegible] and the uterine ligaments shortened. This specimen may not prove to be one of ectopic pregnancy. If it should, however, it will represent gestation but 29 days after the cessation of menstruation.

[illegible]

Dr. Otto H. [illegible]

Dr. E. L. Cornell: It seems to me that Dr. [illegible] having seen so many short cords in a hundred [illegible] able to listen to the fetal heart at short intervals so that if any outward signs appear, such [illegible] scope.

Dr. [illegible] 50 labors. All these cases which had the cord about the [illegible] gave definite symptoms relative to the passages, the passenger, or forces. It would seem that [illegible] or worried at [illegible] frequency is based on a comparatively few [illegible] and as these cases accumulate it may be found that the [illegible] the [illegible] [illegible] these [illegible] We should pay a little more attention in the observation of our cases, to the forces, the passages, especially to the heart of the baby in the first, and certainly in the [illegible] I believe that [illegible] and in the majority of cases. Not only can a short cord be diagnosed as being about the neck, but one may with a considerable degree of probability diagnose which way it is wrapped [illegible] The [illegible] the way the head is influenced in its rotation by the [illegible]

Dr. H[illegible]: I [illegible] Dr. K[illegible] [illegible] perhaps [illegible]

Dr. K[illegible]: [illegible] died: but only two nights ago a baby which had [illegible]

BOOK REVIEWS

A CRITIQUE OF NEW BOOKS ON SURGERY

THERE is probably no subject upon which there is more diversity of opinion than upon the treatment of certain non-malignant affections of the stomach. The amount of work that has been done and the literature written is enormous, in fact so voluminous that it is beyond the comprehension of the average man. It is, therefore, with much interest that we are offered a little volume by Cumston and Patry.[1] As Moynihan says in his introduction to this volume: "There are wide diversions of opinion between physicians and surgeons concerning the need for surgical treatment in non-malignant diseases of the stomach. Neither the physician nor the surgeon undertakes adventures into the territory of the other with that frequency which would be of benefit to both, and so far as details of surgical treatment are concerned there is nothing approaching unanimity among surgeons whose experience is considerable. A fresh and intimate study of the whole subject is urgently needed, and consequently a work such as this written by surgeons who have devoted great talents and a wealth of care to a close study of these affections and their treatment will be eagerly welcomed in every land."

The authors after discussing various surgical procedures on the stomach, divide their text into the treatment of the following conditions: stenosis, ulcers, gastric dystopia and dilatation, nervous dyspepsia, disturbances of the gastric secretions, tuberculosis, syphilis, and traumatic lesions of the stomach. In brief, they advocate gastro-enterostomy for benign stenosis of the pylorus, and for infantile hyperpyloric stenosis they advocate the method of Strauss in preference to the Rammsted operation. For the acute ulcer medical treatment is recommended; for the more or less chronic ulcer a month's medical treatment, and then the question is debated whether further medical treatment should be given or surgery should be resorted to. For the definitely chronic ulcer, surgery is recommended without reserve.

The type of treatment seems to be operation by Billroth II method since most of the ulcers are located in the pylorus. They seem to favor the removal of the ulcer-bearing area for various reasons: to prevent perforation, to prevent obstruction, to do away with possibly malignant areas, and to restore normal physiological function.

Hæmorrhage of the stomach is divided into three classes: the acute fulminating, the severe recurring, and chronic hæmorrhage. It seems to be the consensus of opinion that the fulminating hæmorrhage should be let alone, as most of them cease with complete rest of the stomach. The severe recurring hæmorrhage, during the time of the hæmorrhage, should be let alone, but deserves surgery as soon as the patient's general condition warrants. Surgical procedure is then practically the same as for the third type, which is the treatment of chronic ulcer. The authors are most emphatic in stating that the various gastric dystopias, dyspepsia, and various disturbances of secretions should fall to the hands of the internist for medical treatment.

It can thus be seen that this little volume is decidedly a résumé of the ideas of today regarding surgery of non-malignant diseases of the stomach. A reason is given for every procedure and why it is accepted as the most logical course of treatment. There is probably no volume of its size which offers such an abundance of material on this type of diseases of the stomach, and it is, therefore, with much pleasure that it is recommended to the surgical as well as the medical profession. J. A. WOLFER.

UNDER the very capable editorship of Mrs. M. H. Mellish appear the papers from the Mayo Foundation for Medical Education and Research and the Medical School of the University of Minnesota.[2] This collection of papers comprises the articles prepared during the years 1915–20, inclusive.

It is intended that at stated intervals these papers shall appear as a collected volume for the benefit of the profession at large. The present edition, which is Volume I, consists of many rather unusual contributions, many of them dealing with fundamental principles based upon experiments on lower animals. These are of necessity interesting to research workers and to those clinicians especially interested in the subject at hand. Unfortunately, many of the articles appear only as abstracts, which may be disappointing to many who are interested.

Several papers in this volume deserve special attention. Notably among these are Harrington on "The Effect on the Kidney of Various Surgical Procedures on the Blood Supply, Capsules, and on

the Ureters"; also, the article by Bumpus on "Carcinoma of the Prostate." Hedblom gives a very comprehensive description of treatment of "Chronic Empyema." This article is especially interesting since the surgical profession is constantly encountering cases of empyema which become increasingly difficult to treat and cure. Although the author has not brought out anything particularly new, he has emphasized many things which the average man fails to comprehend.

We have been [illegible] therapy. Many questions have been raised as to the peculiar and [illegible] in relation to the injection of foreign proteins. The article by Hermann on "The Liberation of Antibodies in the Injection of Foreign Proteins" is in consequence most interesting, and for those who are unfamiliar with the subject it is of intense interest. Also, the article by Benton on "Nitrogen Metabolism of Bacteria" is of special merit.

Withal, this volume consists of an enormous amount of material, and in spite of the fact that many articles are abstracted, the abstracts usually state in brief the essentials of the article and in this way really accomplish their purpose. It is interesting to note the enormous amount of research work going on in the Institution, which must in the end bring about much good. J. A. W[illegible]

MANY men who have traveled and studied abroad have visited the wonderful clinic at Berne. Probably in no continental European clinic is there such a wealth of material which is dealt with such precision as at the Berne clinic.

DeQuervain, the successor to Kocher, has for many years been a shining light in the European surgical profession. Those who have seen him work cannot help but respect him very profoundly. It is, indeed, fortunate that we are again in receipt of a new edition of his work on surgical diagnosis. This offers such a striking contrast to the usual works on surgical diagnosis that to read it becomes a very pleasing opportunity.

The author has accepted a very novel and original method and instead of the usual stereotyped form of naming a disease and giving the clinical symptoms and physical findings, he [illegible] the subject matter by regions, detailing certain symptoms and findings and what pathological conditions produce them. Consequently, there is more attention paid to accurate clinical physical findings and to a detailed clinical history than is usually the case. One is constantly impressed with the fact that in order to make a correct diagnosis one must have an absolutely correct history of a condition, and that one's physical findings must be very carefully made. Many general findings are given much attention, and it is very interesting to read the paragraph concerning the condition of the tongue [illegible]

"CLINICAL SURGICAL DIAGNOSIS." By F. de Quervain, of Berne, Switzerland. Edited by Frederick Brockway Showalter, M.D. New York: Wm. Wood & Co. 1911.

[illegible] has been a source of great speculation for many [illegible] Many men have devoted much time to the study of the spleen and to [illegible] experimental work has been done, but withal it must be said very little has been discovered. So it is [illegible] interest that the [illegible] of Morrison is received.

Truly there is no man more fitted to give a discussion on this questionable organ than [illegible] Lockwood. There is no man who stands more squarely upon two feet and who allows his mind so little fantastic play as this great surgeon, and consequently anything that comes from his pen [illegible] be read and mastered.

After a rather graphic description of the known anatomical and physiological characteristics of the spleen, the author discusses a series of diseases in which the spleen is known to be involved. Each of these chapters is [illegible] drawings of the anatomical and physiological relations between the liver, spleen, and bone marrow. These drawings very materially assist the reader in grasping a thorough conception of the text. The author does not claim that he has done any particularly original work, but has chosen from the enormous amount of [illegible] and from clinical observations of prominent men of the world, as well as his own experience, those data which to him seem logical and sound. To extract from the world's literature the meat and leave that which is unsound is truly a great task. The result depends entirely upon the caliber of the mind and the judgment of the writer.

The chapter on cirrhosis of the liver is very interesting, as it does away with a great deal of [illegible] of the pathology regarding the [illegible] of the liver.

The little volume is truly an evening's entertainment, and much benefit can be derived from [illegible] J. A. W[illegible]

[illegible] great observers in [illegible] physiology [illegible] Mayo Clinic. This volume appears [illegible] the general [illegible]

medical profession and especially the surgical profession, it is a source of the greatest benefit and [illegible].

It is interesting to note that in the present volume, which is the [illegible], there are 50 contributors to 117 individual papers. Several of the articles are sequelæ to papers which have appeared in previous volumes. It is very difficult to express anything more than a general opinion of this volume. The work is so comprehensive and covers practically every region of the body in such a masterly and thorough fashion that any review is practically impossible.

It might be interesting to state that work dealing with the bacterial causes of many chronic and obscure diseases is especially dealt with by Rochester and others. Such diseases as iritis; hiccups; myositis; kidney, heart, and lung infections, have been studied with the greatest care in correlation with many animal experiments, and the results appear so conclusive and striking that one is forced to accept them in spite of the fact that many European surgeons and research workers look upon the opinions with suspicion.

Gastric surgery, which we all know has found its greatest exponents in Rochester, continues to receive its merited attention. The report on the diagnostic and therapeutic aspects and sequelæ of gastric surgery based on 6400 operations is of the greatest interest. Truly we must observe with the greatest admiration and respect any observations based upon such a large series of cases, and especially so since these cases have been studied by the best of men who are equipped in every way for diagnosis and treatment.

The article by Wilson on malignant tumors of the thyroid deserves special attention. His classifications and studies are, indeed, interesting and are probably the most comprehensive that we have in American literature today. It is difficult not to be attracted to any article which appears in this volume, and countless pages could be written in admiration and respect. Most of these papers have been read before some society or have appeared in some journal, but for those of us who are great admirers of the work of the Mayo Clinic, it is a pleasure to have these papers collected in this form, printed on the best of paper, in clear type, and ready for reference. J. A. Wolfer.

THE uninterrupted search for more effective methods of controlling malignant disease is reflected in three monographs recently published: *Diathermy* by Cumberbatch,[1] *Radium Therapy* by Simpson,[2] and *Radiation Therapy* by Kroenig and Friedrich.[3]

[1] Diathermy. Its Production and Uses in Medicine and Surgery. By [illegible]. London: [illegible], M.V., B.M. Oxon., M.R.C.P., St. [illegible]. C. V. Mosby Company. 1922.

[2] Radium Therapy. By Frank Edward Simpson, A.B., M.D. St. Louis: C. V. Mosby Company. [illegible].

[3] [illegible] Radium and Radium Rays in the Biology of Radiation Therapy. By [illegible]. Authorized translation by Dr. Walter Lampe and Arthur Holding Hertz, M.D. New York: Rebman Company. 1922.

The first is written in an admirably conservative manner and without claiming unqualified success for the method of treatment advocated. It loses some of its effectiveness by a somewhat prolonged description of various instruments for producing diathermy, and of its physiological effects. To the best of our knowledge, the effects of diathermy are simply the result of heating of the tissues. Its peculiar advantage lies in the fact that by reason of the high frequency current used, stimulation and electrolysis of the body tissues are avoided, and the production of heat in the tissues which transmit the current is the sole effect. The intensity of the heat produced and the area affected may be controlled by the size of the electrodes and the strength and duration of the current.

An account of the treatment of neuritis and gonococcal joint infection, and of the removal of malignant tumors of the skin and of the mucous membrane about the mouth and throat is the most suggestive portion of the book. Although in a number of the author's cases of malignant growths diathermy was used only as a last resort, the recorded results are remarkably good. The treatment of neoplasms of the bladder is described briefly. As has been shown in recent periodical literature, this is another field particularly suitable for the application of diathermy.

Dr. Simpson's monograph is an admirable account of our present-day knowledge of radium activity and radium therapy. The first hundred pages are devoted to a discussion of the chemical nature of radium, and radium disintegration products, of the production of radium emanation, and of the physical, chemical, and biological effects of radium rays. An extensive literature has been drawn upon in order to present an accurate idea of the effect of radium upon the body tissues. The following chapters, ten in number, are devoted to a discussion of therapeutic apparatus, the technique of application in different pathological conditions, and the results obtained as illustrated in the author's practice. A comprehensive bibliography completes the work.

The outstanding impression gained from reading Dr. Simpson's book are (1) the splendid results obtained in the treatment of epitheliomata about the mouth and face; (2) the good results obtained in the treatment of cervical uterine cancer; (3) the increasing tendency toward burying radium in the tissues, particularly in the form of radium emanation in glass ampoules.

Epitheliomata and benign new-growths of the skin, such as nævi, keloids, and tuberculous lesions, offer peculiarly favorable conditions for radium treatment, since it is possible definitely to concentrate the radium rays on the diseased tissue. The results of treatment of such lesions are well illustrated in Dr. Simpson's book.

Although the treatment of uterine cervical cancer with radium has not shown such brilliant success, the results compare so favorably with those of other methods of treatment that in certain clinics opera-

tive treatment has been abandoned in favor of radium treatment. This question is still a debatable one, and its settlement must wait on further evidence. The success attained in the treatment of uterine fibromyomata, in the leukæmic enlargement of the spleen, and in rapidly growing tumors of the teratoid type needs no comment.

The great problem in the treatment of malignant growths, that of the treatment of deeply situated tumors, is still a baffling one. The increasing tendency toward burying glass ampoules containing radium emanation, and leaving them *in situ* seems to us very suggestive. It is not unreasonable to hope that in the near future some method will be devised of concentrating radium emanation in a container which will be slowly absorbed in the body tissues and thus permit the radiation of deep tumors as part of a single surgical procedure.

Dr. Schmitz' translation of Krönig and Friedrich's monograph on *Radium Therapy* will appeal particularly to workers and technicians in X-ray and radium therapy. A discussion of the problems involved in measuring X-ray dosage, coming from a clinic which has combined a well-equipped physical laboratory with the wealth of clinical material available at Freiburg, deserves the consideration of every worker in the field of radiation therapy.

Physical methods for estimating radiation energy, experimental determination of the amount of energy absorbed by living tissues, the relation of the hardness and intensity of the ray to the reaction produced, the importance and measurement of secondary radiations are some of the problems which are discussed, and toward whose solution the authors have contributed an important part.

The final answer as to the part radiation therapy may be expected to play in the battle against malignant disease rests on further careful and intensive studies of this type. [illegible]

SUCCESSFUL surgery must be based upon the realization and appreciation of fundamental physiological and anatomical facts. The [illegible] a firm and broad [illegible] one under review, dedicated to setting forth the [illegible] Dr. Hatt [illegible] ject is thoroughly reviewed and presented in a masterly fashion. It is representative of work upon [illegible] depend.

[illegible] the frequently injured facial nerve. [illegible] evaluated. [illegible] juries constitutes a most important rôle in the final [illegible] of a funicular arrangement of fibers in the nerve [illegible] are treated.

[illegible] of the various typical nerve injuries has not [illegible] urgeon might turn to it for aid. A combination of a clinical atlas and a volume such as the author has given us would seem to be ideal.

[illegible] Davis.

AMERICAN COLLEGE OF SURGEONS

HOSPITAL STANDARDIZATION

From Report for 1922, Including List of 1,012 General Hospitals of 50 or more Beds in the United States and Canada Which Meet the Minimum Standard of the College

A HIGH ideal of hospital service, a vision of community responsibility, a method by which this responsibility can be met efficiently day by day — this is Hospital Standardization. The following pages contain a report for 1922 of the progress of this movement — that of giving to the public the best service known to the science of medicine. It stands as a tribute to the idealism and the service of the combined medical and hospital professions.

For the past decade, American hospitals have been passing through a state of change. The development of modern surgery and medicine, the advancement in diagnostic procedure, the forward strides of pathology and roentgenology, made severe and confusing demands upon hospitals. In addition, medical men, hospital executives, and public health officials began to conceive of the hospital in a new light; that of an institution which centralizes in itself every department of modern medicine; which makes itself not only the clearing house for treatment, but also the headquarters for community health activities. Some such conception came to the minds of medical men and hospital executives, who were striving to give their communities the best in modern medicine. And this widening of responsibility was altogether natural. Hospitals, founded on a basis of service, had as their dominant motive the inherent desire to improve this service and to extend it to the entire community. The standardization program of the American College of Surgeons became the medium through which these ideals of the hospitals found adequate expression. It proposed a program of hospital service which voiced the needs and the ideals of hospitals themselves. Small wonder, then, that such a program has been adopted so rapidly. The soil had been prepared, the minimum standard was the seed, and better hospital service was the fruit thereof.

Hospitals ten years ago, as today, varied in size and scope from the clinical teaching organization of the large cities to the tiny hospital often owned and operated by a pioneer surgeon in an outlying town. Could every hospital irrespective of size and financial condition offer reliable, honest service to its patients? Were there any fundamentals for hospitals applicable to every type of institution found in the American continent?

The determination of these fundamentals and their practical application clearly constituted the first step toward improvement. By correspondence and by actual visits to hospitals, the leading medical and hospital minds of America attacked this problem.

These men were not idle theorists — rather they were successful medical men of broad vision and hospital executives who were coping with actual conditions day by day. After careful consideration they elaborated four fundamentals without which no institution is worthy of the name of hospital. Later these fundamentals became known as the Minimum Standard for hospital service, and under the leadership of the American College of Surgeons this standard has been adopted by the majority of hospitals of the United States and Canada.

The success of this movement is one of the most fascinating stories in the annals of American medicine.

ORIGIN OF THE PROGRAM

Soon after its organization, the American College of Surgeons felt the urgent need of improving hospital records, as applicants for admission to the College were required to submit as a part of their examination one hundred case records of major operations. These records were so incomplete and fragmentary in many instances that the College became thoroughly convinced of the necessity for a wide-spread campaign to improve them. This was the initial germ causing the hospital standardization movement; as it developed, other factors in hospital betterment presented themselves, such as the need for more adequate laboratory service and more efficient staff organization. Accordingly, hospital superintendents,

members of boards of trustees, and physicians of national repute were consulted in the endeavor to determine the best plan for instituting the necessary improvements.

Although, in general, the hospitals of the United States and Canada were conducted by reputable institutions, no far-seeing individual could deny the existence of certain weaknesses which needed correction. It was decided in 1918, therefore, to send out questionnaires to all general hospitals in order to obtain complete information concerning the existing status of the following fundamentals: the type of staff organization, the extent to which hospital results were analyzed, the abolition of the practice of fee-division, the status of the case records, and the extent of the laboratory service. Replies to these questionnaires strengthened the growing conviction of the College that a personal survey of hospitals was imperative.

Next, a standard was needed upon which to base the survey, and leading authorities in the medical and hospital world were consulted further with this end in view. It was decided that the standard should be confined to the fundamentals which would insure the best hospital service; that it should be broad enough to be applicable to all general hospitals, and still detailed enough to avoid misinterpretation of the principles involved.

The hospital staff quite naturally was selected as the first essential to be considered in the standard. As a man often may be judged by the company he keeps, so also may a hospital be judged by the character and ability of its staff members. Restriction of staff membership to the ethical and competent, therefore, was admittedly necessary in order for a hospital to live up to its community trust. The necessity for some definite type of staff organization was mentioned because organization leads to efficiency, and lack of efficiency is inexcusable where human lives are concerned. The practice of fee-division was denounced as being absolutely incompatible with honest hospital and medical care; physicians buying and selling patients should have no place on a reputable hospital staff. Hospitals were urged to adopt a constitution and by-laws with specific reference to professional care, the keeping of records, and the attendance at staff meetings, because most hospital constitutions included no mention of such important essentials. Above all, the fundamental importance of regular staff conferences to analyze hospital results was especially emphasized. Failure to hold such meetings, besides being the chief reason for staff disharmony, was responsible for the lack of realizing the full benefit from the hospital's vast clinical experience.

The [illegible] the majority of physicians kept relatively meager office records, the hospital was considered the logical repository for the medical records of the community. It was a regrettable fact that many hospitals could furnish little information as to the amount of study made of each patient before treatment. Inasmuch as [illegible] the value of the procedures carried on in the hospital was too great to permit of their being lost by failure of being recorded.

The rapid strides made by clinical and X-ray laboratories called for a more complete use of these important departments. There was a general deficiency in the quantity and variety of laboratory tests performed in hospitals. The operating room and pathological laboratory needed a closer correlation; each patient was entitled to more routine laboratory service.

With these considerations in view, the minimum standard was evolved in 1919. Whether it has stood the test of time is [illegible] by the fact that it has not been modified since its inception.

THE MINIMUM STANDARD

1. That physicians and surgeons privileged to practice in the hospital be organized as a definite group or staff. Such organization has nothing to do with the question as to whether the hospital is "open" or "closed," nor need it affect the various existing types of staff organization. The staff [illegible] defined as the group of doctors who practice in the hospital inclusive of all groups such as the "regular staff," the "visiting staff," and the "associate staff."

2. That membership upon the staff be restricted to physicians and surgeons who are (a) competent in their respective fields and (b) worthy in character and in matters of professional ethics; that in this latter connection the practice of the division of fees, under any guise whatever, be prohibited.

3. That the staff initiate and, with the approval of the governing board of the hospital, adopt rules, regulations, and policies governing the professional work of the hospital; that these rules, regulations, and policies specifically provide:

   a. That staff meetings be held [illegible] once each month. (In large hospitals the departments may choose to meet separately.

3. That the staff review and analyze at regular intervals the clinical experience of the staff in the various departments of the hospital, such as medicine, surgery, and obstetrics; the clinical records of patients, free and pay, to be the basis for such review and analysis.

4. That accurate and complete case records be written for all patients and filed in an accessible manner in the hospital, a complete case record being one, except in an emergency, which includes the personal history; the physical examination, with clinical, pathological, and X-ray findings when indicated; the working diagnosis; the treatment, medical and surgical; the medical progress; the condition on discharge with final diagnosis; and, in case of death, the autopsy findings when available.

5. That clinical laboratory facilities be available for the study, diagnosis, and treatment of patients, these facilities to include at least chemical, bacteriological, serological, histological, radiographic, and fluoroscopic service in charge of trained technicians.

Designed as a universal, as well as a minimum standard, it must be restricted to the basic principles underlying the best hospital service. There are many variable factors such as size, type, and location, which influence a hospital's procedure in carrying out certain policies. To meet these varying conditions, the standard omits any detailed description of how its principles should be enacted. It leaves this for each hospital to decide in accordance with local needs. Where there are several equally efficient means to an end, dogmatism in insisting upon one method hampers hospital initiative. This limitation to fundamentals, and avoidance of unnecessary detail, gives the standard sufficient elasticity to meet varying situations. The viewpoint of the College looks toward certain end-results, rather than upon specific methods to be used in securing such results.

The College recognizes the importance of many features not mentioned in its standard; these lack, however, sufficient uniformity in various hospitals, states, and provinces to warrant an equitable basis for comparison and rating. The published report of approved hospitals must be just. And the more complicated the standard, the greater will be the likelihood of error in selecting the list of institutions meeting it. It is believed, furthermore, that in the careful observance of all the principles of this standard, the various unmentioned features will be cared for automatically.

THE HOSPITAL STAFF

The first consideration in the minimum standard, and rightly so, is the hospital staff. It is unfortunately true that organization in hospital effort has not advanced to a degree comparable with its development in other technical lines. Surely there is no excuse for the human repair shop — the hospital — to fall behind in organization, always all important in promoting the highest efficiency. Responsibility for the various activities of the hospital must be centered in certain committees or individuals. The program for the staff meetings, the case records, the laboratory service, the nursing care, and the interne service, are but a few of the important activities, the responsibility for which should be centralized.

As the strength of a chain varies with its individual links, so the status of a hospital rises and falls with the strength or weakness of its component staff members. Restriction of hospital privileges to the ethical and competent, therefore, is essential.

The goal of the organized staff, and indeed the aim of the standardization program, is the analysis of the hospital's results. As expressed by Mr. John G. Bowman, "the staff meeting is the pivot upon which the success or failure of hospital standardization turns." It is the medium, through which this entire campaign finds expression. Without it, a hospital's efforts to a large degree fail.

The form of this analysis varies according to the type of organization. Whether combined staff meetings or departmental conferences are held is immaterial, so long as all the special activities of the hospital are represented.

The staff conference, perhaps more than any other factor, has improved the tone of hospital service during the past few years. It is the feeling of the College that these meetings should be devoted largely to a discussion of the so-called casualties, including deaths, infections, complications, and unimproved cases. Occasional hospitals still adhere to the belief that such meetings violate the confidential relationship existing between the physician and his patient. One naturally assumes that all the physicians present in a given staff meeting are ethical and competent; if not, they have no place on the hospital staff. Granting this assumption, all that occurs in this meeting is held in strict confidence by each physician present. The names of the patients are not divulged during the conference. The discussion is impersonal, being an analysis of a clinical event, and the relationship of that event to the hospital. Even if the patient's name be

known to a few, it should have no bearing subsequent to the meeting.

Experiences encountered in hospital practice probably exceed in value those resulting from any other line of endeavor, and their true value is not approached, unless they are considered at a staff conference. The confidential relationship between the physician and his patient is maintained, but it is elevated to the much broader conception of a confidence reposed in a frank, co-operative group of fellow practitioners — the hospital staff.

LABORATORY

One of the great advances in modern medicine has been in the direction of laboratory aid in diagnosis. Indeed, this constitutes one of the greatest distinctions between the practice of medicine today and that of our forefathers. Hospitals owe their patients the benefits of this advance in medical science. The laboratory in no sense, however, should be considered as a shortcut to diagnosis, supplanting the careful taking of a history and a painstaking physical examination. Combined with the latter, however, it furnishes an invaluable means of assistance, often making clear an otherwise obscure diagnosis.

The necessity, then, for making careful arrangements for adequate laboratory service, needs no argument. As a minimum, hospitals should have facilities for the examination of urine, blood, exudates, bacteriological slides, and for the growth of cultures. It may be impractical, however, for some hospitals to have equipment for the more technical examinations, such as serological and histological tests. Arrangements must be made with a reliable laboratory for accurate and prompt service for these more detailed examinations. Where material has to be sent outside of the hospital, there is an unfortunate tendency to reduce the number of specimens sent. As a result, laboratory service suffers. Unfortunately, the number of qualified pathologists and serologists is too small to supply each hospital individually, and as inaccurate laboratory reports are worse than none, the only recourse at the present time is the practice of sending certain specimens to adjacent laboratories.

To help obviate this difficulty it is customary to employ technicians. Adequate provision for their supervision, however, is often neglected. If a pathologist is not available, some staff member versed in laboratory work, should be selected for this purpose.

Even in hospitals with complete laboratory facilities, one frequently finds laboratory service markedly deficient, due to the insufficient quantity of tests performed, usually by private patients. This is due largely to two causes: first, the system of charging an individual fee for each test performed; and second, to the apathy of many staff members toward the laboratory. It cannot be too strongly emphasized that almost without exception, hospitals which charge individual fees for laboratory work perform a relatively small number of tests per patient. Under such conditions, naturally, the hospital cannot assume a definite routine of laboratory service, as an immediate objection to the cost would be raised. The only solution apparent at the present time is the adoption of a flat-rate fee. This allows the hospital, and rightly, to assume the responsibility of having each patient receive adequate laboratory aid. The uniform success of this plan has been proved in so many instances, that it can be accepted as established fact.

The installation of X-ray equipment has proceeded so rapidly that the supply of roentgenologists can scarcely meet the demand. Although technicians may become proficient in many phases of the work, the problem of adequate roentgenological interpretation is more difficult to meet. Each X-ray department should have a qualified roentgenologist in charge, if only in a part-time, supervisory capacity. Patients, in general, do not receive uniformly competent service if interpretations are relegated to individual physicians.

The College makes no specific recommendations concerning the number of routine laboratory examinations to be employed by hospitals. A routine urinalysis, of course, is performed in the majority of hospitals. Many perform a routine hæmoglobin determination and leucocyte count also—a practice to be strongly recommended. Some hospitals have a routine Wassermann test in certain wards or services. Fortunately, the practice of having a routine examination of every tissue removed in the operating room is becoming quite prevalent. This is a factor of paramount importance. Every specimen from the operating room should be sent to the laboratory automatically; this should be as rigid a part of the operating room technique as the sterilization of instruments. Every specimen should be examined by the pathologist, who submits at least a gross report of his examination and has a histological examination made whenever possible. Data of tremendous scientific value are becoming available due to the practice of sectioning practically all specimens from the operating room. Furthermore, this practice gives the hospital an insight into its operating room service that can be obtained in no other way.

Case Records

The fundamental importance of case records is a commonly acknowledged fact and needs no argument here. A careful study of the history of a patient's illness and a painstaking physical examination are procedures of such great importance that their value must be preserved. Failure to record these data, constitutes a tremendous economic loss and waste, to say nothing of the future bearing on the welfare and lives of the patients. How then, can the possession of a complete record system be facilitated? Its accomplishment requires the mutual co-operation of the hospital and its staff members.

The duties of the hospital in this connection consist, first of all, in supplying adequate personnel to secure the records. In the absence of internes, record clerks are essential. Even the small hospital is entitled to a full-time historian, although it is quite common for these historians to devote part of their time to other activities of the hospital. It is because the responsibilities and many duties of the historian are so little realized that so small an amount of time is allotted to her. With careful training she can record many of the essential points of the personal history; the physical examination records should be taken by dictation from the physicians. This relieves the staff members of considerable time and labor. In addition, the historian should keep close watch of the current records to see that they are recorded promptly; she notes whether the history, physical examination record, and working diagnosis are recorded before operations; she keeps in close touch with the progress notes, which explain the course of the patient's illness; and she checks over the records carefully to see that they are complete before filing.

An efficient record committee is a necessary adjunct to the historian's work. In this committee is vested the responsibility for the interpretation of the records. Other of its functions are a persuasive stimulation of the physicians to improve their records; a periodical review of the charts of the discharged patients; and the selection of the records to be analyzed at the staff conference.

Many hospitals fail to provide adequate space for the record department. For this purpose a room large enough to contain the records of many years should be set aside, adjacent to the hospital office. All plans for new hospitals should bear this important feature in mind. This department should contain standard filing cabinets and card indices for names and diseases; for each record must be immediately accessible. The cost of this equipment is slight in proportion to the value received; perhaps no expenditure is more warranted.

After supplying the equipment and personnel needed for a modern record department, the hospital can expect the physicians to insure the accuracy of the records. Although much of the time and labor in securing records can be borne by the hospital, the responsibility for the records themselves lies with the physicians. Unless constantly checked and supervised by the staff members, the records will contain many inaccuracies. In many small hospitals the physicians write all the records personally. Whether recorded by internes, historians, or dictated to clerks, however, the physicians should scrutinize the records closely and signify their approval in writing before the charts are filed. Physicians too often take no interest in the records of their patients written by internes; as a result, the records are frequently inaccurate and brief. Staff supervision is a great stimulus to internes, the character of whose work reflects the interest displayed in it by the staff members.

Personal study in over sixteen hundred hospitals during the past four years has shown a progressive improvement in the records. Certain prevalent shortcomings, however, are worthy of special emphasis. Extreme brevity is a common fault, coupled with a tendency to dismiss important regions of the body from consideration by too promiscuous use of the words "normal," or "negative." A tendency to a stereotyped form of history and physical examination record is encountered frequently. Such charts have little individuality or clinical value and result from two causes: failure to record the data until shortly before or after the patient's discharge; and from lack of supervision of the records by the hospital staff.

The importance of having the working diagnosis recorded early is insufficiently realized. This, in itself, will correct many existing difficulties in connection with other phases of the records. Operation records are almost universally weak in describing the exploratory findings and operative technique. The solution for this seems to be the dictation of these data during or immediately following each operation.

Case records are not to be filed and forgotten; if so, most of their potential value is lost. Inseparably linked with the staff conference, the records form the only basis for a true analysis of a hospital's results. The depth of this analysis varies in direct proportion with the detail and completeness of the records. Many treasures are

buried in hospital record rooms for lack of discovery and analysis. Experience has proved that the greatest future advances in hospitals will be in the direction of statistical, analytical research based on complete records.

THE METHOD AND [illegible]

The hospital surveys of the College are personal surveys. Experience has shown that a study of hospital conditions through correspondence and questionnaires leads to many inaccuracies. The College surveys are conducted through a trained corps of hospital visitors, all of whom are graduates in medicine. The number of visitors employed in any year has never exceeded nine, since the uniformity of a survey varies in inverse proportion with the number of men employed. By using relatively few visitors, all similarly trained, the College obtains strictly uniform reports. As an additional safeguard, each visitor covers a large number of states and provinces in order that he may obtain a general, rather than a sectional viewpoint of hospital conditions. This uniformity in the reports is an absolute essential to a just rating of hospitals. Upon such detailed personal surveys, the College is dependent for an accurate estimate of each hospital's status relative to the minimum standard.

The purpose of the visitors is to explain the minimum standard, to interpret its application to each hospital, and to offer constructive criticism and helpful suggestions to remedy any existing shortcomings. This campaign is one of suggestion only; there is no element of coercion entailed. It succeeds through the support and approval of the hospitals themselves.

Other organizations interested in hospital betterment have played a prominent rôle in advancing hospital standardization. The program of the College has been enhanced greatly by the endorsement of such organizations as the American Hospital Association, the American Conference on Hospital Service, the Canadian Medical Association, the Catholic Hospital Association, the Conference Board of Hospitals and Homes of the Methodist Church, the Medical and Surgical Section of the American Railway Association, the Methodist Hospital Association, the Protestant Hospital Association, and numerous state, provincial, and local organizations.

Internes and nurses are using the approved list of the College as a guide in the selection of institutions in which to pursue their training. The public is making increasing use of it as a means of determining which institutions offer safe and competent hospital care. Benevolent foundations [illegible] worthy of financial aid. [illegible] railroad employees, wherever possible [illegible] hospitals meeting the minimum standard. The United States Government [illegible] beneficiaries of the Veterans' Bureau, utilizes the information [illegible] the approved list of the College.

[illegible] the United States and Canada have been made. Of the institutions having one hundred or more beds, [illegible] the number of approved [illegible] 812 hundred bed general hospitals are on the approved list.

[illegible] of beds [illegible] the College have not included these smaller institutions.

[illegible] having fifty or more beds, there are 1012 or [illegible] meeting the requirements of the standard.

[illegible]

Although the College has been surveying the smaller hospitals [illegible] advisable to withhold their publication on the approved list until [illegible] give them an opportunity to familiarize themselves thoroughly with the standardization program.

The smaller hospitals are under greater difficulties than the larger institutions. Many are [illegible] to be practically self-supporting; the physicians are more prone to develop personal rivalries which retard staff organization; it is difficult for them to obtain internes; and sufficient laboratory service is often a serious problem. In spite of these difficulties, however, the small hospitals have welcomed the minimum standard with the same spirit manifested by the large institutions. [illegible] greatest change in hospital service has been manifested [illegible] harmoniously functioning staffs [illegible] adequate laboratory [illegible] tutions are to be especially commended, therefore, on the excellent showing which they have made.

In the United States and Canada there are 811 general hospitals having between fifty and one hundred beds. Of these, 335 or 41 per cent are on the approved list. This exceeds the percentage of hundred bed hospitals which met with approval at the time of the first survey.

The surveys of the College have demonstrated that the hospitals of this continent are receptive to any means of improving their service to the public. As the sphere of hospitals has widened, so have their responsibilities increased. Sensing these ever deepening responsibilities and obligations, hospitals looked forward to a means of satisfying their broadened conception and ideals of community service. The minimum standard and the standardization program of the College furnished a concrete method by which these aspirations could be reached. The future will see the further elaboration by hospitals of the principles of the minimum standard, and a fuller realization of the spirit embodied therein.

LIST OF APPROVED HOSPITALS

Capacity of 50 Beds and Over

The following list contains the names of those general hospitals of fifty or more beds, in the United States and Canada, which meet the minimum standard. In this list a certain number of the institutions are designated with an asterisk. This group includes those hospitals which, when visited, had adopted the fundamental principles of the minimum standard, but which at that time had not developed all of them to a degree meriting the fullest approval. The hospitals listed without an asterisk have received the benefits of a longer experience in the workings of the program and consequently a broader conception of its application.

UNITED STATES

ALABAMA

100 or more beds

*Birmingham Baptist Hospital, Birmingham
Employees Hospital, T. C. I. & R. R. Co., Birmingham
Hillman Hospital, Birmingham
Mobile City Hospital, Mobile
*Norwood Hospital, Birmingham
*Providence Infirmary, Mobile
*St. Vincent's Hospital, Birmingham
South Highlands Infirmary, Birmingham

50 to 100 beds

*Alabama Baptist Hospital, Selma
*John A. Andrew Memorial Hospital, Tuskegee
Vaughan Memorial Hospital, Selma

ARIZONA

100 or more beds

*St. Joseph's Hospital, Phoenix

ARKANSAS

100 or more beds

Logan H. Roots Memorial Hospital, Little Rock
St. Louis Southwestern Hospital, Texarkana
St. Vincent's Hospital, Little Rock
*Sparks Memorial Hospital, Fort Smith

50 to 100 beds

Baptist State Hospital, Little Rock
*Leo N. Levi Memorial Hospital, Hot Springs
Michael Meagher Memorial Hospital, Texarkana
St. Bernard's Hospital, Jonesboro
St. Luke's Hospital and Annex, Little Rock

CALIFORNIA

100 or more beds

Alameda County Hospital, San Leandro
Children's Hospital, Los Angeles
Children's Hospital, San Francisco
*French Hospital, San Francisco
*Fresno County Hospital, Fresno
*Golden State Hospital, Los Angeles
Hospital of the Good Samaritan, Los Angeles
Lane Hospital, San Francisco
*Loma Linda Sanitarium and Hospital, Loma Linda
Los Angeles County Hospital, Los Angeles
Mary's Help Hospital, San Francisco
Mt. Zion Hospital, San Francisco
*O'Connor Sanitarium, San Jose
Pasadena Hospital, Pasadena
Providence Hospital, Oakland
*Sacramento Hospital, Sacramento
St. Francis Hospital, San Francisco
St. Joseph's Hospital, San Diego
St. Joseph's Hospital, San Francisco
St. Mary's Hospital, San Francisco
St. Vincent's Hospital, Los Angeles
San Diego County Hospital, San Diego
San Francisco Hospital, San Francisco
*San Joaquin General Hospital, French Camp
Santa Barbara Cottage Hospital, Santa Barbara
Santa Clara County Hospital, San Jose
Santa Fe Coast Lines Hospital, Los Angeles
Southern Pacific Hospital, San Francisco
University of California Hospital, San Francisco
White Memorial Hospital, Los Angeles

50 to 100 beds

*Mercy Hospital, Bakersfield
*Murphy Memorial Hospital, Whittier
*Paradise Valley Sanitarium, National City
*Ramona Hospital, San Bernardino
*St. Francis Hospital, Santa Barbara

*This list is complete to [illegible]. Any subsequent changes it necessary will appear in the bulletin [illegible]

COLORADO

100 or more beds

Children's Hospital, Denver
Glockner Sanatorium, Colorado Springs
Mercy Hospital, Denver
Minnequa Hospital, Pueblo
St. Anthony's Hospital, Denver
St. Francis Hospital, Colorado Springs
*St. Joseph's Hospital, Denver
*St. Luke's Hospital, Denver
St. Mary's Hospital, Pueblo

50 to 100 beds

*Denver and Rio Grande Western Railroad Hospital, Salida
*Red Cross Hospital, Salida

CONNECTICUT

100 or more beds

Bridgeport Hospital, Bridgeport
Grace Hospital, New Haven
Greenwich General Hospital, Greenwich
Hartford Hospital, Hartford
*Hospital of St. Raphael, New Haven
Lawrence and Memorial Associated Hospitals, New London
New Haven Hospital, New Haven
St. Francis Hospital, Hartford
St. Mary's Hospital, Waterbury
St. Vincent's Hospital, Bridgeport
*Stamford Hospital, Stamford
Waterbury Hospital, Waterbury

50 to 100 beds

New Britain General Hospital, New Britain

DELAWARE

100 or more beds

Delaware Hospital, Wilmington

50 to 100 beds

*Homeopathic Hospital, Wilmington

DISTRICT OF COLUMBIA

100 or more beds

Central Dispensary and Emergency Hospital, Washington
Children's Hospital, Washington
Columbia Hospital for Women, Washington
Freedman's Hospital, Washington
Garfield Memorial Hospital, Washington
George Washington University Hospital, Washington
Georgetown University Hospital, Washington
Providence Hospital, Washington
†Washington Sanitarium and Hospital, Washington

FLORIDA

100 or more beds

†Duval County Hospital, Jacksonville
*St. Luke's Hospital, Jacksonville

50 to 100 beds

Gordon Keller Memorial Hospital, Tampa
*Miami City Hospital, Miami

[illegible]

†[illegible]
[illegible] Atlanta
Harbin Hospital, [illegible]
[illegible]
St. [illegible] Infirmary, [illegible]
[illegible]

*Athens General Hospital, [illegible]
[illegible]
*Park View Sanitarium, Savannah
Scottish Rite Hospital, [illegible]

IDAHO

St. Alphonsus Hospital, [illegible]

50 to 100 beds

[illegible]
[illegible] Hospital, Walla
St. Anthony's Hospital, Pocatello
St. [illegible] Hospital, [illegible]

ILLINOIS

100 or more beds

[illegible]
Augustana Hospital, Ch[illegible]
[illegible]go Lying-in Hospital, [illegible]
Children's Memorial Hospital, Ch[illegible]
Columbus Hospital, [illegible]
Cook County Hospital, Chicago
Evanston Hospital, Evanston
*Frances E. Willard Hospital, Ch[illegible]
Grant Hospital, Ch[illegible]
[illegible]
*Hinsdale Sanitarium, Hinsdale
*Hospital of St. Anthony de Padua, Chicago
Illinois Central Ho[illegible]
Illinois Charitable Eye and Ear Infirmary, [illegible]
*[illegible]
Lutheran Deaconess Hospital, Ch[illegible]
[illegible]
Michael Reese Hospital, Ch[illegible]
Misericordia Hospital, Chicago
Mt. Sinai Hospital, Chicago
Presbyterian Hospital, [illegible]
[illegible]
[illegible]
[illegible]
*St. Elizabeth's Hospital, [illegible]
*St. Elizabeth's Hospital, Danville
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
St. Luke's Hospital, Chi[illegible]
*St. Mary's Hospital, East St. Louis
St. Ma[illegible]
*St. Mary's Infirmary, [illegible]
[illegible]
South Shore Hospital, Chicago
Swedish Covenant Hospital, [illegible]
University H[illegible]
*Washington Park Hospital, [illegible]
[illegible]

*Columbus Extension Hospital, Chicago
Memorial Hospital, Pana
Illinois Masonic Hospital, Chicago
Hospital, Chicago
*Lutheran Hospital, Mo
Our Saviour's Hospital, Jacksonv
Passavant Memorial Hospital, Jacksonville
pital, Chica
Hospital, Murphysboro
Francis Hospital, Freeport

INDIANA

Hospital, Gary
olis City Hospital, Indianapolis
Methodist Episcopal Hospital, Indianapolis
Robert W. Long Hospital, Indianapolis
St. Anthony's Hospital, Terre Haute
St. Elizabeth's Hospital, LaFayette
St. Joseph's Hospital, Fort Wa
St. Margaret's Hospital, Hammond
St. Mary's Hospital, Evansville
St. Mary's Mercy Hospital, Gar
St. Vincent's Hospital, Indianapolis

50 to 100 beds

Epworth Hospital, South Bend
LaFayette Home and Hospital, LaFayette
Muncie Home Hospital, Muncie
*Protestant Deaconess Home and Hospital, Evansville
*Reid Memorial Hospital, Richmond
St. Joseph's Hospital, South Bend
*Union Hospital, Terre Haute
Walker Hospital, Evansville

IOWA

Finley Hospital, Dubuque
Jennie Edmundson Hospital, Council Bluffs
Mercy Hospital, Cedar Rapids
Mercy Hospital, Davenport
St. Francis Hospital, Waterloo
St. Joseph's Mercy Hospital, Dubuque
St. Joseph's Mercy Hospital, Sioux City
St. Vincent's Hospital, Sioux City
University Hospital,

*Iowa Congregational Hospital, Des Moines
*Lutheran Hospital, Sioux City
*Ottumwa Hospital, Ottumwa
Park Hospital, Mason City
St. Joseph's Mercy Hospital, Clinton
St. Joseph's Mercy Hospital, Fort Dodge
St. Joseph's Mercy Hospital, Mason City
*St. Joseph's Mercy Hospital, Waverly
Samaritan Hospital, Sioux City

KANSAS

Bethany Methodist Hospital, Kansas City
St. Francis Hospital, Wichita
St. Margaret's Hospital, Kansas City
Wichita Hospital, Wichita

50 to 100 beds

Axtell Hospital, Newton
Bell Memorial Hospital, Kansas City
Halstead Hospital, Halstead
Hutchinson Methodist Hospital, Hutchinson
*Mercy Hospital, Fort Scott
*Mt. Carmel Hospital, Pittsburg
Providence Hospital, Kansas City
St. Elizabeth's Hospital, Hutchinson
St. Francis Hospital, Topeka
St. John's Hospital, Salina
*St. Joseph's Hospital, Concordia

KENTUCKY

100 or more beds

Good Samaritan Hospital, Lexington
Louisville City Hospital, Louisville
Norton Memorial Hospital, Louisville
St. Anthony's Hospital, Louisville
*St. Elizabeth's Hospital, Covington
SS. Elizabeth and Mary Hospital, Louisville
St. Joseph's Hospital, Lexington
St. Joseph's Infirmary, Louisville

50 to 100 beds

*Booth Memorial Hospital, Covington
Children's Free Hospital, Louisville
*Deaconess Hospital, Louisville
Illinois Central Hospital, Paducah
*Jewish Hospital, Louisville

LOUISIANA

Charity Hospital, New Orleans
Hotel Dieu, New Orleans
*Presbyterian Hospital, New Orleans
St. Francis Sanitarium, Monroe
T. E. Schumpert Memorial Hospital, Shreveport
Touro Infirmary, New Orleans

*Illinois Central Railroad Hospital, New Orleans
North Louisiana Sanitarium, Shreveport

MAINE

Eastern Maine General Hospital, Bangor
Maine General Hospital, Portland
*St. Mary's General Hospital, Lewiston

50 to 100 beds

Children's Hospital, Portland

*Allegany Hospital, Cumberland
Franklin Square Hospital, [illegible]
Mercy Hospital, Baltimore
Morrow Hospital, Baltimore
St. Agnes Hospital, Baltimore
Union Memorial Hospital, Baltimore
University Hospital, Baltimore

Children's Hospital School, Baltimore
Emergency Hospital, Easton

Beverly Hospital, Beverly
Boston City Hospital, Boston
Brockton Hospital, Brockton
Cambridge City Hospital, Cambridge
Carney Hospital, Boston
City Hospital, Fall River
*Cooley-Dickinson Hospital, Northampton
House of Mercy Hospital, Pittsfield
Long Island Hospital, Boston
Lowell Corporation Hospital, Lowell
Lowell General Hospital, Lowell
Lynn Hospital, Lynn
Massachusetts Charitable Eye and Ear Infirmary, Boston
Massachusetts General Hospital, Boston
Memorial Hospital, Worcester
Mercy Hospital, Springfield
New England Hospital for Women and Children, Boston
Newton Hospital, Newton Lower Falls
*Noble Hospital, Westfield
Peter Bent Brigham Hospital, Boston
Providence Hospital, Holyoke
St. Elizabeth's Hospital, Boston
St. John's Hospital, Lowell
*St. Luke's Hospital, New Bedford
St. Vincent's Hospital, Worcester
Salem Hospital, Salem
Springfield Hospital, Springfield
Union Hospital, Fall River
*Waltham Hospital, Waltham
*Wesson Memorial Hospital, Springfield
Worcester City Hospital, Worcester

Beth Israel Hospital, Boston
Boston Lying-in Hospital, Boston
Clinton Hospital, Clinton

Infant[illegible]
River

MICHIGAN

Hospital
Hackley Hospital, [illegible]
*Hurley Hospital, Flint
University Hospital, [illegible]
[illegible]tal, Ishpeming
Mercy Hospital, Jackson
*Nichols Memorial Hospital, [illegible]
Saginaw General Hospital, Saginaw
St. Mary's Hospital, Saginaw
[illegible]ritan Hospital, [illegible]

MINNESOTA

*Charles T. Miller Hospital, [illegible]
City and County Hospital, [illegible]
[illegible]l, Minneapolis
Fairview Hospital, Minneapolis
Minnesota State Hospital for Indigent Children
Park Sanitarium, St. Paul
Paul
[illegible]pital, Minneapolis
St. Barnabas Hospital, Minneapolis
St. Joseph's Hospital, St. Paul
*St. Luke's Hospital, Duluth
*St. Luke's Hospital, St. Paul

St. Paul
[illegible]

[illegible]

Hill Crest Surgical Hospital, Minneapolis
*Immanuel Hospital, Mankato
St. Gabriel's Hospital, Little Falls
[illegible]
*St. Joseph's Hospital, Mankato
St. Raphael's Hospital, St. Cloud

MISSISSIPPI

100 or more beds

East Mississippi Charity Hospital, Meridian

MISSOURI

100 or more beds

Alexian Brothers Hospital, St. Louis
Barnes Hospital, St. Louis
Children's Hospital, Kansas City
Christian Church Hospital, Kansas City
*Evangelical Deaconess Home and Hospital, St. Louis
Frisco Employees Hospital, St. Louis
*Grace Hospital, Kansas City
Jewish Hospital, St. Louis
Kansas City General Hospital, Kansas City
Lutheran Hospital, St. Louis
Missouri Baptist Sanitarium, St. Louis
Missouri Pacific Railroad Hospital, St. Louis
Research Hospital, Kansas City
St. Anthony's Hospital, St. Louis
St. John's Hospital, St. Louis
St. Joseph's Hospital, Kansas City
St. Louis Children's Hospital, St. Louis
St. Louis City Hospital, St. Louis
St. Louis Mullanphy Hospital, St. Louis
St. Luke's Hospital, St. Louis
St. Mary's Hospital, Kansas City
St. Mary's Infirmary, St. Louis

50 to 100 beds

Bethesda Hospital, St. Louis
*Frisco Employees Hospital, Springfield
*Parker Memorial Hospital, Columbia
*St. Francis Hospital, Cape Girardeau
St. Francis Hospital, Maryville
St. John's Hospital, Joplin
St. Luke's Hospital, Kansas City
St. Mary's Hospital, Jefferson City
Trinity Lutheran Hospital, Kansas City
University Hospital, Kansas City

MONTANA

100 or more beds

Columbus Hospital, Great Falls
Montana Deaconess Hospital, Great Falls
Murray Hospital, Butte
St. James Hospital, Butte
*St. Patrick's Hospital, Missoula

50 to 100 beds

*Bozeman Deaconess Hospital, Bozeman
*Northern Pacific Beneficial Association Hospital, Missoula
St. Ann's Hospital, Anaconda
*St. Joseph's Hospital, Lewistown
St. Vincent's Hospital, Billings

NEBRASKA

100 or more beds

Nebraska Methodist Episcopal Hospital, Omaha
[illegible]
St. Francis Hospital, Grand Island
St. Joseph's Hospital, Omaha
St. Mary's Hospital, Columbus
University of Nebraska Hospital, Omaha

[illegible]

*Immanuel Deaconess Hospital, Omaha
Presbyterian Hospital, Omaha
*Swedish Mission Hospital, Omaha

NEVADA

[illegible]

*Elko General Hospital, Elko

NEW HAMPSHIRE

100 or more beds

St. Joseph's Hospital, Nashua

[illegible]

*Elliott Hospital, Manchester
*Hospital of Notre Dame, Manchester
Mary Hitchcock Memorial Hospital, Hanover
Nashua Memorial Hospital, Nashua

NEW JERSEY

100 or more beds

Alexian Brothers Hospital, Elizabeth
Atlantic City Hospital, Atlantic City
Bayonne Hospital and Dispensary, Bayonne
Christ Hospital, Jersey City
Cooper Hospital, Camden
Elizabeth General Hospital, Elizabeth
Englewood Hospital, Englewood
Hackensack Hospital, Hackensack
Jersey City Hospital, Jersey City
Mercer Hospital, Trenton
Monmouth Memorial Hospital, Long Branch
Morristown Memorial Hospital, Morristown
Mountainside Hospital, Montclair
Muhlenberg Hospital, Plainfield
Newark Beth Israel Hospital, Newark
Newark City Hospital, Newark
Newark Memorial Hospital, Newark
*Newark Presbyterian Hospital, Newark
Orange Memorial Hospital, Orange
Passaic General Hospital, Passaic
Paterson General Hospital, Paterson
St. Elizabeth's Hospital, Elizabeth
St. Francis Hospital, Jersey City
St. Francis Hospital, Trenton
*St. Joseph's Hospital, Paterson
*St. Mary's Hospital, Hoboken
*St. Michael's Hospital, Newark
*St. Peter's General Hospital, New Brunswick

50 to 100 beds

Ann May Memorial Hospital, Spring Lake
*Homeopathic Hospital, Newark
*Hospital and Home for Crippled Children, Newark
*Hospital for Women and Children, Newark
*Middlesex General Hospital, New Brunswick
Nathan and Miriam Barnert Memorial Hospital, Paterson
*St. James Hospital, Newark

Albany Hospital, Albany
*Arnot-Ogden Memorial Hospital, Elmira
Bellevue Hospital, New York
Beth Israel Hospital, New York
Beth Moses Hospital, Brooklyn
*Binghamton City Hospital, Binghamton
Broad Street Hospital, New York
Brooklyn Hospital, Brooklyn
Brownsville and East New York Hospital, Brooklyn
Buffalo City Hospital, Buffalo
Buffalo General Hospital, Buffalo
Buffalo Hospital for Sisters of Charity, Buffalo
*Bushwick Hospital, Brooklyn
Carson C. Peck Memorial Hospital, Brooklyn
Children's Hospital, Buffalo
Clifton Springs Sanitarium, Clifton Springs
Community Hospital, New York
Coney Island Hospital, Brooklyn
Cumberland Street Hospital, Brooklyn
Ellis Hospital, Schenectady
Flower Hospital, New York
Flushing Hospital and Dispensary, Flushing
Fordham Hospital, New York
French Benevolent Society Hospital, New York
Gouverneur Hospital, New York
Greenpoint Hospital, Brooklyn
Hahnemann Hospital, New York
Harlem Hospital, New York
Highland Hospital, Rochester
Holy Family Hospital, Brooklyn
Homeopathic Hospital, Albany
Hospital of the Good Shepherd, Syracuse
Jewish Hospital, Brooklyn
Kings County Hospital, Brooklyn
Lebanon Hospital, New York
Lenox Hill Hospital, New York
Lincoln Hospital, New York
Long Island College Hospital, Brooklyn
Manhattan Eye, Ear, and Throat Hospital, New York
Memorial Hospital, New York
Methodist Episcopal Hospital, Brooklyn
Metropolitan Hospital, New York
Misericordia Hospital, New York
Montifiore Hospital, New York
Mt. St. Mary's Hospital, Niagara Falls
Mt. Sinai Hospital, New York
Mt. Vernon Hospital, Mt. Vernon
New York City Hospital, Blackwell's Island, New York
*New York Eye and Ear Infirmary, New York
New York Foundling Home, New York
New York Hospital, New York
New York Hospital for Ruptured and Crippled, New York
New York Infirmary for Women and Children, New York
New York Nursery and Child's Hospital, New York
New York Orthopedic Hospital, New York
New York Post-Graduate Hospital, New York
New York Skin and Cancer Hospital, New York
*New York State Hospital, West Haverstraw
Niagara Falls Memorial Hospital, Niagara Falls
Norwegian Lutheran Deaconess Hospital, Brooklyn
Oneida County Hospital, Rome
Presbyterian Hospital, New York
Rochester General Hospital, Rochester
Rochester Homeopathic Hospital, Rochester
Roosevelt Hospital, New York
St. Catherine's Hospital, Brooklyn
St. Francis Hospital, New York
St. John's Brooklyn Hospital, Brooklyn
St. John's Hospital, Long Island
St. Joseph's Hospital, Yonkers
St. Joseph's Hospital, Syracuse
St. Luke's Hospital, New York
St. Mark's Hospital, New York
St. Mary's Free Hospital for Children, New York
St. Mary's Hospital, Brooklyn
St. Mary's Hospital, Rochester
St. Peter's Hospital, Albany
St. Peter's Hospital, Brooklyn
St. Vincent's Hospital, New York
St. Vincent's Hospital, Troy
Sloane Hospital for Women, New York
Staten Island Hospital, Tompkinsville
Syracuse Memorial Hospital, Syracuse
Trudeau Hospital, Trudeau
Women's Hospital, New York
Woman's Hospital Hospital, Brooklyn
Yonkers Hospital Hospital, Yonkers

Anthony N. Brady Maternity Hospital, Albany
Auburn City Hospital, Auburn
Bronx Hospital, New York
Brooklyn Maternity Hospital, Brooklyn
Columbia Presbyterian Hospital, New York
Columbus Hospital, New York
Emergency Hospital of Sisters of Charity, Buffalo
Fanny Hospital, Utica
*Frederick Ferris Thompson Hospital, Canandaigua
*General Hospital, Syracuse
Geneva City Hospital, Geneva
Glens Falls Hospital, Glens Falls
*Harbor Hospital, Brooklyn
Jamaica Hospital, Jamaica
Lincoln Maternity Hospital, New York
Kensington Hospital, New York
Lawrence Hospital, Bronxville
Mary Immaculate Hospital, Jamaica
Mary McClellan Hospital, Cambridge
New York Hospital Metropolitan Hospital
*Nathan Littauer Hospital, Gloversville
New Rochelle Hospital, New Rochelle
Ossining Hospital, Ossining
Park Avenue Clinical Hospital, Rochester
Presbyterian Hospital, New York
Prospect Heights Hospital, Brooklyn
Reconstruction Hospital, New York
St. Bartholomew's Hospital, New York
St. Christopher's Hospital for Babies, Brooklyn
St. Vincent's Hospital, West New Brighton
Saratoga Hospital, Saratoga Springs
*Swedish Hospital, Brooklyn
Williamsburg Hospital, Brooklyn

Alice Walker Memorial Hospital, Wilmington
*Presbyterian Hospital, Charlotte
St. Leo Hospital, Greensboro
Watts Hospital, West Durham

Asheville Mission Hospital, Asheville
Asheville Good Samaritan Hospital, Asheville
Burrus-McCain Hospital, Highpoint
Cone Memorial Hospital, Greensboro

Highsmith Hospital, Fayetteville
*Long's Sanitarium, Statesville
[illegible] Rocky Mount
Rutherford Hospital, Rutherfordton
*Salisbury Hospital, Salisbury

NORTH DAKOTA

[illegible] more beds

Bismarck Evangelical Deaconess Hospital, Bismarck
*[illegible] Forks Deaconess Hospital, Grand Forks
St. [illegible] Hospital, Bismarck
St. [illegible] Hospital, Fargo
St. [illegible] Hospital, Fargo

50 to 100 beds

*St. Joseph's Hospital, Minot
St. [illegible] Hospital, Grand Forks

OHIO

[illegible] or more beds

*[illegible] Hospital, Canton
Bethesda Hospital, Cincinnati
Christ Hospital, Cincinnati
Cincinnati General Hospital, Cincinnati
City Hospital, Akron
Cleveland City Hospital, Cleveland
[illegible] Samaritan Hospital, Cincinnati
[illegible] Samaritan Hospital, Zanesville
Grant Hospital, Columbus
Hawkes Hospital of Mt. Carmel, Columbus
Huron Road Hospital, Cleveland
Jewish Hospital, Cincinnati
Lakeside Hospital, Cleveland
Lucas County Hospital, Toledo
Mercy Hospital, Hamilton
Mercy Hospital, Toledo
Miami Valley Hospital, Dayton
Mt. Sinai Hospital, Cleveland
*Peoples Hospital, Akron
Protestant Hospital, Columbus
St. Alexis Hospital, Cleveland
St. Elizabeth's Hospital, Dayton
St. Elizabeth's Hospital, Youngstown
St. Francis Hospital, Columbus
St. John's Hospital, Cleveland
*St. Joseph's Hospital, Lorain
St. Luke's Hospital, Cleveland
St. Mary's Hospital, Cincinnati
St. Rita's Hospital, Lima
St. Vincent's Hospital, Cleveland
St. Vincent's Hospital, Toledo
Springfield City Hospital, Springfield
Toledo Hospital, Toledo
University Homeopathic Hospital, Columbus
Youngstown Hospital, Youngstown

50 to 100 beds

*[illegible] City Hospital, Alliance
Bellaire City Hospital, Bellaire
Bethesda Hospital, Zanesville
Children's Hospital, Columbus
Children's Hospital and Mary Day Nursery, Akron
Deaconess Hospital, Cincinnati
*Fairview Park Hospital, Cleveland
Flower Hospital, Toledo
Glenville Hospital, Cleveland
*Good Samaritan Hospital, Sandusky
Lakewood Hospital, Cleveland
*Lima Hospital, Lima
Mansfield General Hospital, Mansfield
*[illegible] City Hospital, [illegible]
Maternity and Children's Hospital, Toledo
*Memorial Hospital, Fremont
Mercy Hospital, Canton
Mercy Hospital, Columbus
*Newark City Hospital, Newark
[illegible] Hospital, Toledo
St. Ann's Infant Asylum and Maternity Hospital, Cleveland
Salem Hospital, Salem
Scarlet Oaks Sanitarium, Cincinnati
Schirrman Hospital, Portsmouth
*Warren City Hospital, Warren

OKLAHOMA

[illegible] or more beds

St. Anthony's Hospital, Oklahoma City
State University Hospital, Oklahoma City

50 to 100 beds

*Wesley Hospital, Oklahoma City

OREGON

100 or more beds

Emanuel Hospital, Portland
Good Samaritan Hospital, Portland
*Hot Lake Sanatorium, Hot Lake
St. Vincent's Hospital, Portland

50 to 100 beds

*Portland Sanitarium, Portland
Portland Surgical Hospital, Portland
*Sacred Heart Hospital, Medford

PENNSYLVANIA

100 or more beds

Allegheny General Hospital, Pittsburgh
Allentown Hospital, Allentown
Altoona Hospital, Altoona
Braddock General Hospital, Braddock
Chester County Hospital, West Chester
Chester Hospital, Chester
Children's Homeopathic Hospital, Philadelphia
Children's Hospital, Pittsburgh
Clearfield Hospital, Clearfield
Columbia Hospital, Pittsburgh
Conemaugh Valley Memorial Hospital, Johnstown
Easton Hospital, Easton
Elizabeth Steel Magee Hospital, Pittsburgh
Frankford Hospital, Philadelphia
George F. Geisinger Hospital, Danville
Germantown Dispensary and Hospital, Philadelphia
Hahnemann Hospital, Scranton
Hahnemann Medical and Surgical Hospital, Philadelphia
Hamot Hospital, Erie
Harrisburg Hospital, Harrisburg
Homeopathic Medical and Surgical Hospital, Pittsburgh
Hospital of the Protestant Episcopal Church, Philadelphia
Hospital of the University of Pennsylvania, Philadelphia
Hospital of the Women's Medical College, Philadelphia
J. Lewis Crozer Hospital, Chester
Jefferson Medical College Hospital, Philadelphia
Jewish Hospital, Philadelphia
Lancaster General Hospital, Lancaster
Lankenau Hospital, Philadelphia
*McKeesport Hospital, McKeesport

Medico-Chirurgical Hospital, Philadelphia
Memorial Hospital, Philadelphia
Mercy Hospital, Philadelphia
*Mercy Hospital, Philadelphia
Mercy Hospital, Pittsburgh
Mercy Hospital, Wilkes-Barre
Methodist Episcopal Hospital, Philadelphia
Misericordia Hospital, Philadelphia
Mount Lebanon Hospital, Pittsburgh
Mt. Sinai Hospital, Philadelphia
Passavant Hospital, Pittsburgh
Pennsylvania Hospital, Philadelphia
Philadelphia General Hospital, Philadelphia
Philadelphia Polyclinic Hospital, Philadelphia
Pittsburgh Hospital, Pittsburgh
Pottsville Hospital, Pottsville
Presbyterian Hospital, Philadelphia
Presbyterian Hospital, Pittsburgh
Reading Hospital, Reading
Robert Packer Hospital, Sayre
Sacred Heart Hospital, Allentown
St. Agnes Hospital, Philadelphia
St. Francis Hospital, Pittsburgh
St. John's General Hospital, Pittsburgh
St. Joseph's Hospital, Lancaster
St. Joseph's Hospital, Philadelphia
St. Joseph's Hospital, Pittsburgh
St. Joseph's Hospital, Reading
St. Luke's Hospital, South Bethlehem
St. Margaret's Hospital, Pittsburgh
St. Mary's Hospital, Philadelphia
St. Vincent's Hospital, Erie
Samaritan Hospital, Philadelphia
South Side Hospital, Pittsburgh
*State Hospital for Insane, Norristown
State Hospital of Middle Coal Fields, Hazelton
State Hospital of Northeastern Anthracite Coal Region, Scranton
Washington Hospital, Washington
Western Pennsylvania Hospital, Pittsburgh
Wilkes-Barre City Hospital, Wilkes-Barre
Wills Hospital, Philadelphia
Women's Homeopathic Hospital, Philadelphia
Women's Hospital, Philadelphia
York Hospital and Dispensary, York

100 beds

Abington Memorial Hospital, Abington
*Bainbridge Private Hospital, Philadelphia
Bryn Mawr Hospital, Bryn Mawr
Carlisle Hospital, Carlisle
Chestnut Hill Hospital, Philadelphia
Children's Hospital, Philadelphia
Children's Hospital of the Medical Department, University of Pennsylvania, Philadelphia
Citizens General Hospital, New Kensington
Germantown Hospital, Philadelphia
Howard Hospital, Philadelphia
Indiana Hospital, Indiana
J. C. Blair Memorial Hospital, Huntingdon
*Jewish Maternity Hospital, Philadelphia
*Joseph Price Memorial Hospital, Philadelphia
*Mercy Hospital, Altoona
Monongahela Memorial Hospital, New Eagle
Montefiore Hospital, Pittsburgh
*Northwestern General Hospital, Philadelphia
Oil City Hospital, Oil City
Palmerton Hospital, Palmerton
Philadelphia Lying-in Charity Hospital, Philadelphia
Preston Retreat Hospital, Philadelphia

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Women's [illegible]or Women, P[illegible]

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[illegible]nitarium, Chick Springs
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McKennan H[illegible]
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St. Mary's Hospital, Pierre

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[illegible] Hospital of State of Tennessee, Nashville

[illegible]

Baptist Hosp[illegible]
Baylor Hospital, Dallas
[illegible]

Hotel Dieu, Beaumont
John Sealy Hospital, Galveston
Parkland Hospital, Dallas
Providence Sanitarium, Waco
Robert B. Green Memorial Hospital, San Antonio
St. Joseph's Infirmary, Fort Worth
St. Joseph's Infirmary, Houston
St. Mary's Infirmary, Galveston
St. Paul's Sanitarium, Dallas
Santa Rosa Infirmary, San Antonio
*Santa Fe Hospital, Temple
Temple Sanitarium, Temple

50 to 100 beds

All Saints Hospital, Fort Worth
Harris Sanitarium, Fort Worth
*Johnson and Beall's Hospital, Forth Worth
King's Daughters' Hospital, Temple
St. Joseph's Infirmary, Paris

UTAH

100 or more beds

Dr. W. H. Groves Latter Day Saints Hospital, Salt Lake City
Holy Cross Hospital, Salt Lake City
St. Mark's Hospital, Salt Lake City
*Thomas D. Dee Memorial Hospital, Ogden

VERMONT

100 or more beds

Mary Fletcher Hospital, Burlington

50 to 100 beds

Fanny Allen Hospital, Winooski
Heaton Hospital, Montpelier
*Rutland Hospital, Rutland

VIRGINIA

100 or more beds

*Chesapeake and Ohio Hospital, Clifton Forge
Hospital Division of Medical College of Virginia, Richmond
Norfolk Protestant Hospital, Norfolk
St. Vincent's Hospital, Norfolk
Stuart Circle Hospital, Richmond
University of Virginia Hospital, Charlottesville

50 to 100 beds

Elizabeth Buxton Hospital, Newport News
Jefferson Hospital, Roanoke
Johnston-Willis Sanitarium, Richmond
*King's Daughters' Hospital, Staunton
Lake View Hospital, Suffolk
Lewis-Gale Hospital, Roanoke
*Riverside Hospital, Newport News
St. Elizabeth's Hospital, Richmond
St. Luke's Hospital, Richmond
Sarah Leigh Hospital, Norfolk

WASHINGTON

100 or more beds

Children's Orthopedic Hospital, Seattle
Columbus Sanitarium, Seattle
King County Hospital, Seattle
Maria Beard Deaconess Hospital, Spokane
†Northern Pacific Hospital, Tacoma
Providence Hospital, Seattle
Sacred Heart Hospital, Spokane
St. Elizabeth's Hospital, North Yakima
St. Joseph's Hospital, Tacoma
St. Luke's Hospital, Spokane
St. Mary's Hospital, Walla Walla
Seattle City Hospital, Seattle
Seattle General Hospital, Seattle
Swedish Hospital, Seattle
Tacoma General Hospital, Tacoma

50 to 100 beds

†Minor Hospital, Seattle
†St. Joseph's Hospital, Aberdeen
Virginia Mason Hospital, Seattle

WEST VIRGINIA

100 or more beds

Charleston General Hospital, Charleston
Kessler-Hatfield Hospital, Huntington
Ohio Valley Hospital, Wheeling
St. Mary's Hospital, Clarksburg
Sheltering Arms Hospital, Hansford
†Welch Hospital No. 1, Welch
Wheeling Hospital, Wheeling

50 to 100 beds

*Beckley Hospital, Beckley
*Bluefield Sanitarium, Bluefield
*Chesapeake and Ohio Hospital, Huntington
Coal Valley Hospital, Montgomery
Davis Memorial Hospital, Elkins
*Guthrie Hospital, Huntington
*McKendree Hospital No. 2, McKendree
*St. Luke's Hospital, Bluefield

WISCONSIN

100 or more beds

LaCrosse Lutheran Hospital, LaCrosse
Luther Hospital, Eau Claire
Madison General Hospital, Madison
Mercy Hospital, Janesville
Milwaukee County Hospital, Milwaukee
Milwaukee Hospital, Milwaukee
Mt. Sinai Hospital, Milwaukee
St. Agnes Hospital, Fond du Lac
St. Francis Hospital, LaCrosse
St. Joseph's Hospital, Marshfield
St. Joseph's Hospital, Milwaukee
St. Mary's and Mercy Hospitals, Oshkosh
St. Mary's Hospital, Green Bay
*St. Mary's Hospital, Milwaukee
*St. Mary's Hospital, Superior
Trinity Hospital, Milwaukee

50 to 100 beds

Columbia Hospital, Milwaukee
*Evangelical Deaconess Hospital, Milwaukee
Grandview Hospital, LaCrosse
*Holy Family Hospital, Manitowoc
†LaCrosse Public Hospital, LaCrosse
Milwaukee Children's Hospital, Milwaukee
†Milwaukee Maternity and General Hospital, Milwaukee
*Misericordia Hospital, Milwaukee
St. Elizabeth's Hospital, Appleton
St. Joseph's Hospital, Dodgeville
St. Mary's Hospital, Madison
St. Mary's Hospital, Racine

WYOMING

50 to 100 beds

†Wheatland Hospital, Wheatland

CANADA

ALBERTA

General Hospital, Calgary
General Hospital, Edmonton
Holy Cross Hospital, Calgary
Medicine Hat Hospital, Medicine Hat
Misericordia Hospital, Edmonton
Royal Alexandra Hospital, Edmonton

*Galt Hospital, Lethbridge
Lamont Public Hospital, Lamont

Provincial Royal Jubilee Hospital, Victoria
Royal Columbian Hospital, New Westminster
Royal Inland Hospital, Kamloops
St. Joseph's Hospital, Victoria
St. Paul's Hospital, Vancouver
Vancouver General Hospital, Vancouver

50 to 100 beds

*Vernon Jubilee Hospital, Vernon

100 or more beds

Brandon General Hospital, Brandon
Children's Hospital, Winnipeg
Misericordia Hospital, Winnipeg
St. Boniface Hospital, St. Boniface
Winnipeg General Hospital, Winnipeg

*Victoria Hospital, Winnipeg

100 or more beds

General Public Hospital, St. John

50 to 100 beds

*Chipman Memorial Hospital, St. Stephen
Hotel Dieu, Campbellton
Hotel Dieu, Chatham
Miramichi Hospital, Newcastle
Moncton Hospital, Moncton
St. John's Infirmary, St. John
Victoria Public Hospital, Fredericton

NOVA SCOTIA

100 or more beds

St. Joseph's Hospital, Glace Bay
Salvation Army Maternity Hospital, Halifax
Victoria General Hospital, Halifax

50 to 100 beds

Aberdeen Hospital, New Glasgow
Children's Hospital, Halifax
*General Hospital, Glace Bay
Highland View Hospital, Amherst
*St. Martha's Hospital, Antigonish

ONTARIO

100 or

Carleton County Pr
General Hospital, Toronto
St. Lu
*Welland County Hospital, Welland
Wellesley Hospital, To

Charlottetown Hospital, Charlottetown
Prince Edwar

Children's Memorial Hospital, Montreal
General de St. Vincent Hospital,
Hotel Dieu, Montreal
Montreal General Hospital, Montreal
Royal Victoria Hospital, Montreal
Sainte Justine Pour Les Enfants, Montreal
Western Hospital, Montreal

Montreal Maternity Hospital, Montreal

100

St. Paul's Hospital,

re Dame Hospital, North Battleford
Prince Albert

GROUP MEETINGS OF STATE AND PROVINCIAL SECTIONS OF THE CLINICAL CONGRESS OF THE AMERICAN COLLEGE OF SURGEONS, SEPTEMBER, 1922

THE Autumn sectional meetings of the American College of Surgeons were held from September 1 to September 12 in Winnipeg, Regina, Tacoma and Salt Lake City. All of these meetings were well attended and there was abundant evidence of growing interest and enthusiasm in the program of the College. Not only was the interest shown by the Fellows of the College, but as well by other members of the profession, those interested in hospitals and the public. The surgical clinics and scientific meetings appealed to the professional man interested in the scientific practice of surgery. The hospital conferences were a direct stimulus to those interested in the improvement and establishment of the highest standards of efficiency and public service in our hospitals. The public meetings were the means of setting before the people the standards of healthful living and the methods for attaining those standards. There was a direct appeal for a strong co-operation of all agencies toward better health.

Those taking part in the September tour of 1922 were Dr. Franklin H. Martin, Director-General; Dr. Malcolm T. MacEachern; Dr. Frederic A. Besley; Dr. Robert E. McKechnie; Reverend C. B. Moulinier, S.J., and Dr. D. A. Craig.

The general program for the public meetings, with the exception of a few alterations, was as follows:

The Meaning of the American College of Surgeons to the Public. Franklin H. Martin, M.D., Director-General, American College of Surgeons.

The Hospital Standardization Program of the American College of Surgeons. Malcolm T. MacEachern, A.M., M.D., Ottawa, Ontario. Associate Director for Canadian Activities, American College of Surgeons.

What the Public Should Know about Cancer. Robert E. McKechnie, M.D., C.M., Vancouver, B. C. Consulting Surgeon, Vancouver General Hospital.

Experimental Medicine. Frederic A. Besley, M.D., Chicago, Illinois. Professor of Surgery, Northwestern University Medical School.

Better Hospitals. Reverend C. B. Moulinier, S.J., Milwaukee, Wisconsin. President, Catholic Hospital Association.

Modern Public Health. D. A. Craig, M.D., Halifax, Nova Scotia. Canadian Red Cross Society, Nova Scotia Division.

The general program for the Hospital Conferences follows:

The Hospital Program of the American College of Surgeons. Franklin H. Martin, M.D.

Hospital Standardization from the Surgeon's Standpoint. Robert E. McKechnie, M.D., C.M., Vancouver, B. C. Frederic A. Besley, M.D., Chicago, Illinois.

Hospital Standardization from the Patient's Standpoint. D. A. Craig, M.D., Halifax, Nova Scotia.

Hospital Standardization from the Hospital Superintendent's Standpoint. Local Hospital Superintendent.

The Soul of Hospital Standardization. Reverend C. B. Moulinier, S.J., Milwaukee, Wisconsin.

Hospital Standardization in Canada. Malcolm T. MacEachern, M.D., Ottawa, Ontario.

Round Table Discussion: Led by Malcolm T. MacEachern, M.D.

Manitoba Section

The Manitoba sectional meeting of the American College of Surgeons was held in Winnipeg on Friday and Saturday, September 1 and 2. There was a large attendance from various parts of the Province. Much of the success of the meetings was due to the energetic work of the local committee which put forth every effort to make the program interesting and instructive to all those in attendance.

The hospital standardization meeting was held in the Medical Building of the University of Manitoba at 2:00 p.m. on the first day. There was a large attendance of physicians, nurses, sisters, and all those interested in hospitals. Dr. J. A. Gunn, chairman of the Manitoba Executive Committee of the American College of Surgeons, presided. The general program for hospital meetings was carried out, with the addition of a short address on "Hospital Standardization from the Standpoint of the Hospital Superintendent," by Dr. G. F. Stephens, superintendent of the Winnipeg General Hospital.

Following the hospital meeting a Round Table Conference was conducted by Dr. Malcolm T. MacEachern. At this conference many important points concerning hospital management were brought up for discussion.

The public meeting was held in the Central Congregational Church at 8:00 p.m., and, al-

though the weather was not favorable, there was a large and enthusiastic attendance.

Dr. J. A. Gunn presided, and after a few opening remarks called upon the Mayor of the city, who extended a hearty welcome to the representatives and Fellows of the College attending the meetings. His Worship also expressed himself as heartily in accord with the movement for better hospitals, better medical service, and better health.

The clinics conducted at the hospitals during the meetings were well attended and [illegible] evidence of scientific interest and effort on the part of those conducting them. [illegible] on the afternoon of the second day the scientific meeting was held at the Manitoba Medical School. A series of excellent papers was presented and there was much discussion. The program was as follows:

Intestinal Tuberculosis. Illustrated. Dr. J. A. Stewart, M.D., Superintendent, Ninette Sanatarium, Ninette, Manitoba.

The Problem of Safe [illegible] from the Surgeon's Viewpoint. (Illustrated.) Frederic A. Besley, M.D., Chicago, Illinois.

Arteriomesenteric Ileus. James McKenty, M.D., Winnipeg.

Operative Obstetrics. H. M. Little, M.D., C.M., Montreal, Quebec. Associate Professor of Gynecology and Obstetrics, McGill University.

Discussion on Papers.

Closing Remarks. Franklin H. Martin, M.D., Chicago, Illinois.

Adjournment.

Saskatchewan and Alberta Sections

On September 4 and 5, the Saskatchewan and Alberta sectional meetings were held in Regina. The usual procedure was carried out with regard to the program. Dr. Andrew Croll of Saskatoon, the local chairman, presided at the meetings.

At the afternoon hospital conference, besides the prescribed program, Dr. M. R. Bow, superintendent of the Regina Hospital, gave an interesting talk on Hospital Standardization from the Hospital Superintendent's Viewpoint.

The public meeting was held in the City Hall. There was a large and interested audience. At this meeting Dr. Robert E. McKechnie of Vancouver, a member of the Board of Regents of the College, was present and gave an instructive address on "What the Public Should Know about Cancer." All the Regina meetings and clinics were well attended by representatives from both the Provinces of Alberta and Saskatchewan.

Washington, British Columbia, Oregon, and Idaho Sections

The sectional meeting for Washington, British Columbia, Oregon, and Idaho was held in Tacoma on September [illegible]. The clinics were conducted at the Scottish Rite Cathedral and the Colonial Emergency Hospital. St. Joseph's Hospital [illegible] at the Tacoma Hotel. Dr. John B. McNerthney, [illegible] meetings. Besides the usual afternoon program of the hospital [illegible] a conference was held by Mr. Charles Johnson. The hospital superintendent's viewpoint of standardization was discussed by Mr. C. J. Cumming, superintendent of the Tacoma General Hospital. Mr. W. F. Geiger, superintendent of public schools for the city of Tacoma, introduced a new and exceedingly commendable idea. He described how the scheme of hospital standardization had been communicated to the children in the public schools of the city of Tacoma. The children had been taught something of the history of hospitals, the purpose for which they were built and conducted, their value in the community, and the difference between an efficient hospital and one which was not up to standard. Mr. Geiger's efforts in this regard were an innovation and called forth much favorable commendation.

The evening public meeting at Tacoma was the largest of the series. The Scottish Rite Cathedral was packed to the doors and many stood in the entrance and at the back of the gallery during the entire meeting. The [illegible] evening program was carried out and was received with splendid enthusiasm by the large audience. The clinics and the scientific sessions were well attended and showed evidence of careful preparation by those taking part in them. At Tacoma, the representatives of the College were exceedingly fortunate in having the opportunity of meeting Mr. S. M. Jackson, who is head of the Board of Trustees of the Tacoma General Hospital, and to whose energetic efforts the excellent standard of that hospital at the present time is largely due.

Utah, Colorado and Wyoming Sections

The sectional meeting for the States of Utah, Colorado, and Wyoming was held in Salt Lake City on September [illegible]. The meetings, with the exception of the hospital clinics, were held in the Utah Hotel, and were well attended. Dr. Frederick Stauffer of Salt Lake City, local chairman, presided at the general meetings.

The usual program of the evening meeting was augmented by an excellent address from Judge Harold M. Stephens of Salt Lake City on "The Public Value of Professional Organization." The program of the scientific meeting held at the Utah Hotel was as follows:

Postoperative Thrombosis of the Veins of the Leg. J. E. Tyree, M.D., Salt Lake City.

Complications and Mortality Causes, Following Prostatectomy. W. G. Schulte, M.D., Salt Lake City.

The Value of Muscle Transplantation in the Correction of Ocular Movements. Edward Jackson, M.D., Denver, Colorado.

Sarcoma of the Extremities from the Surgeon's Viewpoint. Frederic A. Besley, M.D., Chicago, Illinois.

All these papers were very interesting, instructive, and well prepared, and were productive of considerable discussion.

At the hospital conference, Mr. B. F. Grant, superintendent of the Latter Day Saints Hospital, Salt Lake City, discussed the superintendent's standpoint of standardization.

September Sectional Meetings

The September sectional meetings of the American College of Surgeons were without doubt a definite proof of the value of the work of the College and the place which it is assuming in the public mind today. It is a definite proof to the public that the medical profession is interested in better public service on the part of our hospitals and on the part of the profession. The movement for better health in which the medical profession is anxious and willing to cooperate with other agencies is one of the biggest features of the program of the American College of Surgeons, and one which the members of the College will exert every effort to carry through to a successful issue.

Everywhere the Director-General and his staff were shown the kindliest hospitality. All those taking part in the meetings returned to their homes feeling that not only had these meetings been interesting and instructive from a scientific and professional point of view, but that they had served as well to establish a spirit of friendship and unity between the members of the College, the medical profession, and the public at large.

Coming Meetings

Illinois at Quincy, December 1–2.

Indiana at Evansville, December 4–5.

Ohio and Michigan at Cincinnati, December 8–9.

SURGERY, GYNECOLOGY AND OBSTETRICS

AN INTERNATIONAL MAGAZINE, PUBLISHED MONTHLY

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THE PHYSICIAN AND THE SURGEON[1]

BY HARVEY CUSHING, M.D., F.A.C.S., Boston

"WHY, in God's name, in our days is there such a great difference between the physician and the surgeon? The physicians have abandoned operative procedures to the laity, either, as some say, because they disdain to operate with their hands, or rather, as I think, because they do not know how to perform operations. Indeed, this abuse is so inveterate that the common people look upon it as impossible for the same person to understand both surgery and medicine. It should, however, be understood that no one can be a good physician who has no idea of surgical operations, and that a surgeon is nothing if ignorant of medicine. In a word, one must be familiar with both departments of Medicine."[2]

"*No one can be a good physician who has no idea of surgical operations, and a surgeon is nothing if ignorant of medicine.*" This, gentlemen of the College, is my chosen theme, and lest you think it a novelty of my own I hasten to add that the paragraph quoted is transcribed from writings which exist for us only in manuscript, since Lanfranchi, called the father of French surgery, who expressed this sentiment, lived two centuries before Gutenberg.

When one considers the healthy unification of Hippocratic medicine, why *was* there such a difference in Lanfranc's time, and must we admit that the difference he lamented still exists in ours? Does the shadow of the mediæval schism dividing medicine and surgery, and both from the church, which originated, history tells us, in a thirteenth-century papal decree forbidding the participation of the clergy in any procedure involving the shedding of blood—does the shadow of this schism still lie upon us? What difference, after all, is there between physician and surgeon except in the kind of cases each of them chooses to treat and in the variety of therapeutics applied? And in view of many centuries of separation, do we tend toward reunion or further separation? These are questions which concern in no small degree the very existence of this College.

THE PHYSICIAN'S PROGRESS

We certainly have stumbled along widely divergent therapeutic ways, we lay physicians and lay surgeons. The great physicians of ancient days were first of all given over to a polypharmacy inherited from the Arabians, then to the Law of Signatures with its astounding botanical therapeutics, then to a period of heroic bleedings and purgings and sweatings. Homeopathy followed, and taught the profession a much-needed lesson, and finally cellular pathology and bacteriology came to revolutionize physic by arousing a

[2] Cf. Henry E. Handerson's *Gilbertus Anglicus*. Privately printed. The Cleveland Medical Library Association, 1918, 77 pp.

[1] Presidential address before the American [illegible]

profound skepticism in regard to the efficacy, whatever the dose, of most of the drugs abundantly prescribed for symptomatic purposes. This gave to the traditional practices a staggering blow, and the coal-tar products with synthetic chemistry finally closed the physic-garden, drove plants with a few notable exceptions from the pharmacopœa, and botany from the curriculum.

While all this was going on, much time was spent in evolving "systems" of therapeutics based upon bizarre interpretations of pathology which followed one another in succession, the Brunonian doctrine being one of the last, whereby diseases were either sthenic or asthenic; and a century and a half later we still hear "asthenic states" spoken of as ones which need supporting treatment by alcohol, so that even in these dry days the physician is privileged to prescribe the drug that was Brown's personal undoing, though he lived north of the Tweed.

It is an old saying that the wisest physician is he who knows the uselessness of the most medicines. Nevertheless, in an unfortunate alliance with the apothecaries, at about the time the surgeon was entangled with the barber, the eighteenth-century physician was accustomed to write prescriptions for patients he hadn't seen, while enjoying good company in the coffee-house. Some measure of common sense in matters therapeutic was finally knocked into the profession by the growing appreciation of the self-limitation of many diseases, by the success first of Hahnemannism, and, later, of other cults like Mother Eddy's which revived the therapeutic importance of a neglected principle well known in the Æsculapian temples—the influence of the mind upon body ailments, particularly when imaginary in large part, as so many of them are. Mr. Dooley once sagely remarked that "if the Christian Scientists had a little more science and the doctors more Christianity it wouldn't make much difference which you called in—provided you have a good nurse." And there is no doubt but that Florence Nightingale and her successors have also had much to do with modifying our modern therapeutics.

But the profession has not entirely regained its therapeutic sanity under these benign influences. Those uncritical and poorly-trained physicians who live in glass houses and give welcome to the prescriptions of certain pharmaceutical establishments which elbow their way to our desks on leaflets and postcards, cannot throw stones at the laity who give no less a welcome to nature-healers, herbalists, chiropractors, bone-setters, patent-mediciners, and other charlatans beyond enumeration. Little wonder that the wiser heads, both lay and professional, have about come to the conclusion that we had better limit the number of students in our schools, and let a smaller number, better trained, devote themselves to the prevention of disease and, through public-health measures, keep the bulk of the community well in spite of itself, in much the same way that we protect our live stock.

THE SURGEON'S PROGRESS

While all this has been going on through the centuries, in physic, the surgeon was pursuing an entirely different way, independent of tradition and for the most part, be it said, in rather bad company. A handicraftsman, often a rude, uncultivated, and ignorant though practical fellow of itinerant proclivities, he was rarely utilized in the schools, and when so employed, merely as the tool of the more learned and socially more respected physician. He had broken away from established authority: he ventured to write in the vernacular, and sometimes to operate without the physician's permission. Indeed, he did many unorthodox things. However, he was greatly needed especially in time of war, as Charles V used Vesalius; as four successive Bourbons used Paré; Elizabeth, William Clowes; Charles I, Richard Wiseman; and, to give an example from more modern times, as Napoleon used Larrey. Thus he came to be respected at court, even though he was kept out of the faculties where he was looked upon with scorn not untinged with jealousy. An outcast both of church and profession, he finally climbed into professional and some measure of social esteem about the middle of the eighteenth century by way of the barber-pole. But his long and quarrelsome alliance with the Guild of Barbers, humiliating enough,

was peaceful when compared with the quarrels of the physicians and apothecaries.[1]

A short century after the surgeons succeeded in breaking away from this alliance with "barbary" and were readmitted into the schools on the same footing as the physician, there came Lister on the heels of Pasteur, to revolutionize, not only surgical therapeutics, but at the same time, by the introduction of surgical cleanliness, the very hospitals in which both physic and surgery are practiced. And so it has come about that while the physician today has busied himself in perfecting elaborate methods of diagnosis for many chronic disorders, he rather shrugs his shoulders over therapeutics, whereas, on the other hand, treatment by operative methods has developed amazingly, and there is no gainsaying that in the hands of some it tends to run away with itself as a therapeutic measure.

REUNION OF PHYSICIAN AND SURGEON

Thus, in very rough outline, the two main clinical branches of Medicine, long separated both socially and professionally, have grown in ways so divergent that the fact of their origin from a common stem has become obscured by an accumulation of therapeutic débris left by a succession, on the one hand, of theorists who, like the modern endocrinologist, may perhaps see the patient as a whole but through a mist, and by the modern surgical specialist who sees only a part, but that part so disproportionately he is tempted to remove some of it.

Should these therapeutic groups be allowed to riot in their growth unmolested, branching in all directions at will, or will they bear better fruit if grafted or fertilized or cut back remorselessly? All agree that the time is at hand at least for some judicious pruning both in physic and surgery, and for the removal of sufficient rubbish to permit the main stem of [illegible] to be properly exposed and aerated. This process will be good for both root and branch, but more particularly will it benefit the branches if it has the effect of making the surgeon less of a pure technician and more of a physician, and the physician more capable of utilizing some of the minor procedures of surgery and with a better understanding of the major ones.

"*In a word, one must be familiar with both departments of Medicine,*" and this is no more true today than in the thirteenth century or in the days of Hippocrates. By no means did Lanfranc, in the statement which has been quoted, mean to imply that physicians must practice surgery merely that they will be the better physicians, the better their understanding of surgical therapeutics; and, on the other hand, that no surgeon should be regarded as qualified to undertake operative procedures who is not primarily and thoroughly grounded in medical diagnosis. A graduate in medicine may have a very wide knowledge of surgery or even be a successful teacher of the subject without necessarily being himself an operator, just as one may have a thorough knowledge of music without being a performer. So, also, there may be many activities in which a physician may engage, beneficial to his profession, without necessarily "practicing" or prescribing drugs.

However, when in common parlance we differentiate physician and surgeon we do so only on the basis of therapeutics, and granting the same underlying knowledge of disease, this is all that separates from medicine proper, homeopathy and osteopathy and all the other therapeutic cults, each of which reaches some degree of sanity so soon as it undertakes to perform surgical operations, as in time it is inevitable each one of them should do. There is nothing homeopathic about the scalpel, and when surgery was permitted to creep into this doctrinaire school it was near its end. The osteopath and chiropractor and eclectic and all the others may beware of this, for as soon as they come to engage in surgery, then a thorough medical grounding will be necessary,

so that the natural end of all such cults is, that, dead or alive, they will become swallowed in time by the general profession, distasteful as the dose may be.

METHODS OF TEACHING

Unquestionably, what chiefly influences the direction of its growth is the way in which Medicine as a whole is taught—the way in which its various subdivisions are presented to the student, and the relative stress laid upon them. Whatever their spirit of altruism, most of our students enter the profession as a means of livelihood, and are likely to be influenced by what seems to them, given an ordinary degree of ability, to be the most likely road to an income-producing end, whether it be as a laboratory worker, or public-health official, or physician, or surgeon, or specialist of any sort. A disproportionate amount of teaching, or better and more personal teaching in one subject over another, whereby the student's interest is aroused and he begins to feel a certain amount of confidence in his knowledge, will inevitably lure in that direction the larger number.

The periodical turnover in our curricula is an evidence of the fact that faculties show a perennial dissatisfaction with existing conditions, and strive each of them to find the proper average allocation of subjects; little realizing that it makes no great difference—that the fault lies with us the teachers, not with the curriculum, for Medicine can be successfully taught from many angles if only students are properly stimulated and encouraged to observe and think and do for themselves. But what has become particularly apparent of late, is that the curricular tree has become overloaded by grafting upon the clinical branches an undue profusion of specialties, few of them of fundamental importance even though they doubtless bear fruit of marketable value which dangles before the student's eyes so alluringly that he is prone to forget, or to overlook entirely, the source of origin of the specialty in general Medicine.

There has been a great reaction against this, and our supposedly more progressive schools are engaged in lopping off a number of these clinical branches. Some schools, indeed, have come to pay so much attention to the root and stem that if we do not beware, the top will be cut back so far that there will be neither foliage nor fruit—no medical practice whatsoever—and thereby encouragement will be given to the growth of every conceivable form of quackery which will spring up around us as have the schools of the chiropractor, to fill the depleted ranks of the profession; and the indifferent public is probably worse off than it was before.

Reforms are often necessary, but there are no schools for reformers. They, like the physicians of the Middle Ages, are inclined to administer such drastic treatment that the object of the reform, whatever it may be, relieved of the existing ailment, is left subject to other and more serious ills. Much needed as he is, the reformer rarely advocates homeopathic doses or gives a chance for the malady he would correct to be overcome by natural processes. So far as our diminishing supply of family doctors is concerned, there are many who have come to feel that it would be better for us to send out after two years of clinical study alone, with some additional knowledge of public health, a group of men to be licensed as Bachelors of Medicine. They at least could attend to the ordinary ailments and health of the rural districts, where public opinion is largely made and from which legislation, detrimental or otherwise to the interests of the profession in its campaign for sanitary measures, is likely to emanate.

TEACHING WITHOUT THE PATIENT

It is a curious commentary on our methods, that while we have come to emphasize the importance of teaching the preclinical sciences by practical laboratory exercises so that the student may at least have some first-hand knowledge of the scientific method and may learn to interpret and observe for himself, we have tended, if not to abandon, at least to postpone, to the end of the course, these very methods so far as the clinic is concerned. To be sure, we have long outgrown the time-honored quiz as the basis of teaching, than which nothing could have been less practical. A student may know his textbook thoroughly, may, for example, give without hesitation,

when asked for them in an examination, all the symptoms of that vanishing disease typhoid fever, but if he has to utilize his own observation, senses, and wits, and dig out, himself, the essential symptoms and signs which make the diagnosis possible, he is so incapable of reversing his acquired mental processes that the idea of typhoid fever never enters his bewildered head. Only by prolonged contact with the patient at the bedside can he come to take a good history, to make a proper examination, to learn to separate the wheat from the chaff of the patient's complaints; all of which must precede the interpretation and the treatment of the existing disorder.

The so-called case system of teaching has become highly developed and popularized in certain schools—a diagnostic exercise whereby through the process of elimination and logic the predigested data acquired by a variety of people is presented for discussion and analysis. Such a method is excellent for training in the law, since in the legal profession one argues on the basis of authority and accumulated testimony, in accordance with which satisfactory judgments can be rendered and punishments meted out without even seeing the culprit. But the medical profession has long since broken away from dogma and authority, and though the case system, handled by a lively instructor, provides an interesting exercise in medical diagnosis far superior to the old-time quiz, when carried far, it has the great danger of making logicians of the students, rather than practical physicians. There is some danger lest the student be led to feel that it is unnecessary, for a diagnosis, to examine the patient oneself—someone may get the history, another make a physical examination, still others supply the X-ray findings, the laboratory tests, and so on, while all that the modern physician needs to do is to sit and expound, as did the mediæval anatomist while the barber did his dissections for him. Excellent as they may be, there is nothing practical about such exercises, and if overemphasized they are bad for both teacher and student—for the teacher because he gets out of the habit of making his own thorough examination of the patient; for the student, who gets an [illegible] which an autopsy may confirm or otherwise, is the only thing of importance, and treatment for the most part futile. Meanwhile the patients in their [illegible] even those in the wards, would like to know what these professors who admittedly are having difficulty in telling without looking at the organs, what certain people died from, are going to do to relieve their individual backaches or troublesome cough [illegible] would be just as well to go to a chiropractor next time. Indeed it takes a good deal of explaining to make clear that a lumbar puncture, bismuth studies under the fluoroscope, a blood urea examination, metabolism observations, Wassermann tests, and electrocardiograms made by as many different people, most of them technicians at that, each in their several laboratories—that all these things are necessary preliminaries to the recognition of his malady. All too often, alas, the knowledge thereby gained fails in any way to make him more comfortable, or to prolong his expectation of life. The patient submits to all this and is very glad to know, in the abstract, that diagnosis has become a laboratory science which employs the modern principle of piecework, and that the medical profession looks forward to the prevention of many existent diseases from which posterity will be exempt but "meanwhile, doctor, what can you do to relieve my present discomforts so I may get back to work?" He is inclined like the Irishman to ask, "What has posterity ever done for me?"

THE HOME-TRAINING IN MEDICINE

The curriculum in all of our schools still retains one essentially practical clinical course to which attention may be drawn—a course forced upon us by boards of registration, else even this might be curtailed or lost. It exists in the case of obstetrics, for no student is allowed to get his degree unless he has actually, himself, supervised a certain number of confinements. Here is an actual test of the medical novitiate's resources, the one practical test of what he may be able to do in a possible emergency in a patient's home. Nor would any of us wish to see the students robbed of

this invaluable experience. On the contrary, it would be an admirable thing if the principle could be extended and every student, before his graduation, required, under the control and supervision of his teachers or the district physician of the community, to engage in an actual house-to-house practice, armed perhaps with nothing more than a clinical thermometer, a stethoscope, his fingers, and wits, supplemented perhaps by a microscope and a few aniline dyes. In this way he might learn something at least of the living conditions which modify the health of the people he now only meets in the dispensary, surrounded by all of the paraphernalia and instruments of precision supposed to be necessary for a diagnosis. It is a leaf one might take from the book of certain of the training-schools for nurses whose candidates must prove their capacity to engage in actual home-practice before they can qualify for a degree. One of our highly trained young physicians, long-time resident in a teaching hospital, recently confessed to me that he had just been through one of the most valuable experiences of his ten years of medical study. He had passed his summer on an island where was a large summer community, and in the absence of any local physician he had volunteered to hold office hours and prescribe for the needs of his fellow-sojourners, his principal armament being a thermometer, his microscope, some bandages, and a few simple drugs. Never before had his powers of observation and his common sense been so thoroughly exercised.

THE SURGEON IN OTHER COUNTRIES

It is a curious anomaly that the British surgeon taken as a whole is probably in practical ways a better trained physician than is the American surgeon, and yet he rarely possesses a full medical degree and is apt to pride himself on not being called a doctor. Here, on the contrary, the surgeon though graduated a Doctor of Medicine, not infrequently lapses into the state of being little more than a craftsman who, except for the external parts of the body, makes little or no pretense at diagnosis but expects the "internist," often without any expression of an independent judgment, to show him the way.

Different countries—indeed, different parts of the same country—vary greatly in the attitude of physician or surgeon toward their problems. This past summer, during an all-too-short service as *locum tenens* for Mr. George Gask at St. Bartholomew's Hospital, I have had a most illuminating experience which has left me with the impression that the British student gets a more practical clinical course, based upon far better training in anatomy and gross pathology than do most of our students, and that he is far less inclined to lean upon laboratory accessories in making his diagnosis. He, for a longer time and more intimately, is brought in contact with the 90 per cent of human ailments upon which complicated laboratory tests have no special bearing, and through practical experience is apt to arrive at a reasonably sound conclusion in regard to his patient's disorder and have a shrewd idea of the appropriate form of treatment. True, he may miss some of the more rare conditions, for which, after all, little can be done therapeutically—conditions which our students, with their vastly better laboratory facilities, might recognize in all likelihood. But, should we put side by side at work in a small town the average product of these two methods of teaching, I am inclined to think that the former would be the more resourceful, and exercise greater wisdom though possessed perhaps of less learning. And, after all, the strength of a profession, as of a nation, is represented by its average product.

CARE OF THE MINOR AILMENTS

One looks in vain in the curriculum for a course on the common sense treatment of minor ailments. It has been said by a wise and philosophical lay observer of the profession that so far as he can see, the only difference between the so-called "practical" doctor and the "scientific" one who has had a thorough laboratory training, is that the latter is more likely to cure his patients. But with all personal sympathy for this point of view, the community, particularly its rural portion, still has an enormous need for the common sense practitioner, who for his four undergraduate years, under careful super-

vision, has seen less of complicated laboratory methods and more of the handling of sick people afflicted with the common everyday minor injuries and maladies. Otherwise we shall utterly abandon this all-important work to quacks and charlatans, who may become very skillful at it, in spite of their chicanery. I am not at all sure but that, for most of our schools, some measure at least of the French system would be best, whereby from the very outset of their course medical students are brought in direct contact with patients, and the laboratory courses are given conjointly and possibly prolonged throughout the four years.

We must somewhere and somehow strike a middle ground between over-training in the laboratory and under-training at the bedside, or the reverse. Certainly at the present time our graduates—many of them at least—no longer feel that the rôle of the country d[illegible] or even the general practitioner in the town or city, is at all an alluring one, even a possible one, so dependent have they become on complicated laboratory findings in arriving at a diagnosis. Unquestionably, there is an economic element which also enters into this, for a training in Medicine at the present day is unduly long and expensive, entirely disproportionate to any possible returns to be gained from a rural practice.

STRESS UPON BIOLOGY RATHER THAN ANATOMY AND PATHOLOGY

The present stress laid in this country upon the preclinical laboratory courses, particularly those in chemistry and physiology, has without doubt greatly influenced the entire point of view of the physician, who must have a calorimeter and an electrocardiograph with a technician to operate them, if only to keep in fashion, little realizing that they are scarcely more than research instruments. There has been much talk about the modern physiological schools of physic and surgery, and I presume this means that it is less fashionable for the clinicians to grub in the pathological and anatomical laboratories than formerly. Anatomy and pathology just now appear to the unimaginative to have been thoroughly explored; the pioneers have taken the surface washings, and rather than dig deep for gold we prefer to look elsewhere for novelties [illegible] chance finding.

The [illegible] particularly essential subjects has unquestionably flagged, for they naturally reflect the [illegible] illustration of this than the fact observed in many hospitals, that the physician is less apt than formerly to follow his patients to the operating room, and appears to [illegible] than in days gone by to have a view, during life, of the pathological lesion. His place there [illegible] taken by the radiographer who is more often on hand to see his [illegible] firmed or otherwise. This may be for the reason that the disclosures at the operating table relate to regional pathology, and the surgeon rarely exposes lesions which will enlighten those interested in blood urea, the Wassermann reaction, calorimetric or electrocardiographic estimations.

[illegible]

Does this not mean that the surgeon has become the internist, or, put another way, that the internist (as the physician was once called) has come to do his own surgery? If this be so, it behooves the surgeon to accept [illegible] physician, and the physician, loth as he may be to admit it, that he has undergone a metamorphosis. A year ago this College gave an honorary fellowship to the professor of medicine of the University of Stockholm, who had evolved an operative method, entailing great skill, whereby the adherent lung may be completely collapsed in the treatment of pulmonary tuberculosis. A distinguished member of this College, whose name we perpetuate by an annual oration, first conceived the idea of putting the diseased lung to rest, but it remained for Professor Jacobaeus, a physician, to add a further and important step to the procedure by the intrathoracic division of pleural adhesions—a step which had not been undertaken even by so imaginative and radical a surgeon as was John B. Murphy.

This, indeed, was a very significant and unusual occurrence, but, properly interpreted, the giving of this fellowship was merely an

admission of the successful invasion of the surgical field by one who occupies a chair of medicine and the prompt recognition of his contribution by the surgeons. Similar therapeutic invasions of what was once "internal medicine" have been made by those who because they handle a scalpel and are willing to set broken bones are called surgeons, with no corresponding recognition, so far as I am aware, by societies of physicians.

There are, however, certain exceptions in the case both of individuals and of special societies,—men who without disrespect are called surgeon-generals of army, navy, or marine corps, are apt to hold membership in societies both of physicians and surgeons, even though, like the lamented Gorgas, they may be essentially sanitarians,—societies, too, which recognize the inadvisability of confining their numbers to those averse or otherwise to a participation in surgery. The neurologists, for example, have opened their membership to so-called neuro-surgeons, to the unquestioned benefit of those who do, and those who do not, care personally to employ operative methods of treatment. It has made the surgeons strive to be better neurologists, and given the neurologists a better conception of what therapeutic contributions their surgical colleagues are capable of making. It enables both groups better to keep their feet on solid ground and there is no danger that the society will ever become so overrun by the surgeon as to let operative therapy fly away with itself and jump over the moon.

TENDENCIES IN PHYSIC AND SURGERY

May I indicate the direction of our present drift, as physicians and as surgeons, by citing two recent examples from my own clinic—they are extreme examples, I admit, but they will serve my purposes. Patient Number One was referred for diagnosis from a sanitarium which she had entered because of headaches, and where she had had a long and expensive sojourn. She brought with her a sheaf of records detailing special studies, made by different people, on her blood (even to the coagulation time), cerebrospinal fluid, stools, fields of vision, metabolism, alveolar air, and carbohydrate tolerance. It was an impressive array of findings, all within the normal limits of error. The X-ray, however, had shown a "closed-in sella," and after a period of pituitary gland administration without benefit, she was finally advised to undergo an operation and sent here for that purpose. So far as we could determine, she was an overconscientious and overworked medical librarian greatly in need of a long-postponed vacation, who incidentally had been reading at odd hours a popular book on the ductless glands.

In contrast to this, let us turn to the surgeon-specialist and his outstanding fault, in that he often fails to see the patient whole. At the moment of this writing, Patient Number Two has entered the hospital—a poor fellow who for several years has been having frequent uncinate seizures, associated with a vivid olfactory impression. Meanwhile, he has had nine intranasal operations in separate sessions—a septal resection, ethmoids, sphenoid, and both antra opened and drained, turbinates removed, and finally all his teeth extracted. Of course we smell with our noses; the patient complained bitterly of a disagreeable odor, *ergo* nasal operations. What could be more simple? That he had during all this time an homonymous hemianopsia was not observed. It is a venturesome and expensive thing to consult a surgical specialist who does not see beyond his own—or his patient's nose. And this represents for all of us the great danger of surgical specialization, when carried to an extreme, whether it be in rhinology, gynecology, neurology, or what you will. And when the specialty removes itself from contact with general medicine and retires to an isolated hospital given over to a single class of cases it is a danger still more difficult to avoid. Indeed, a ward in a general hospital, so given over, may become no less a place of isolation with its inevitable narrowing tendencies.

A wise physician and teacher, in discussing internal medicine as a vocation, once said that "the manifestations of almost any one of the important diseases in the course of a few years will box the compass of the specialties." It is no less—perhaps even more—true of surgery, and for this reason I believe it to be fundamentally essential in a general hos-

pital, however inconvenient for the attendants, that conditions represented by the specialties shall be scattered in the wards among the patients still grouped under general surgery, so that staff, house officers, nurses, and students alike shall at least continue to have some due sense of proportion regarding general surgery and surgical specialization, and the relation of both of them to Medicine.[1]

THE RÔLE OF THE COLLEGE

This College of Surgeons in its short life has assumed some very responsible functions. It is playing a not unimportant rôle in international affairs by bringing together through the common bonds of professional interest the surgeons of this western hemisphere—of Canada, Mexico, and South America as well as of the United States. We have much to learn from each other. Another most important task it has undertaken is to improve, and in a measure to standardize the work done in our larger hospitals. The modern "Survey" with public ventilation of its findings is one of our most advantageous methods of bringing about reforms. So our hospitals, some seven hundred in number, which have over one hundred beds each, have been classified with the result that improved methods of organization have been adopted which have enormously safeguarded the patient—particularly the patient destined to undergo the hazards and aftermath of an operation. It has been an expensive and laborious task, this survey, but a task well worth while, and it is now to be extended so as to include the smaller community hospitals of over fifty-bed capacity, which are far and away more numerous.[2]

The College, too, has from the outset taken a vigorous stand against that abomination which prevails, it is said, in some parts of the country to such an extent that public confidence in the profession has been seriously shaken. It is a matter which bears some relation to these very trends of physic and surgery which I have endeavored to make [illegible] earlier in this address—the surgeon becoming a pure operative technician, incapable of making a diagnosis—the physician, impoverished in therapeutic resources and with so poor a conception of surgery that he will let out his patient to the lowest bidder willing to operate at his dictation, and divide the purse.[3] This takes us back to the abuses of the Middle Ages. It is [illegible] exist in any community if the surgeon was trained to make his own diagnosis and if the physician would refuse to employ a su[illegible] incapable of arriving at an independent opinion regarding the necessity or advisability of an operation. For such a surgeon is apt [illegible] equally neglectful of what is often the [illegible] important part of every surgical procedure the after-treatment. The physician who lends himself to such a practice is in the position of one who prescribes a dangerous drug to his patient without knowledge of its dosage or action, for there is no drug in the pharmacopœia so dangerous as misapplied surgery.

It seems to me that it would not be a bad idea if in our tests of eligibility for fellowship in this College—tests which not only are those of moral and professional character but of operative experience and skill—we should demand something more than the mere report upon a fixed number of major operations successfully performed, but should require, as well, information as to whether the diagnosis of these cases were the result of the candidate's own personal observation, or whether they were made for him by another.

We have seen that the present trends affecting the physician and surgeon are, on the one hand, toward preventive medicine and good nursing which lessen the importance of drugs in therapeutics; on the other, in surgery, an ever-increasing subdivision and specialization which tend to magnify the importance [illegible] mere handicraft. Prevention, it is true, [illegible] also be applied in surgery. Many industrial accidents can be prevented: the rule of safety first can be followed, there would be [illegible] gunshot wounds if fire-arms and war were abolished; if we can finally stamp out tuber-

[1] I do not keep [illegible] exchange places [illegible] we at least hold [illegible] week, and ther[illegible] our students [illegible]

[2] It may be noted that [illegible] had adopted by [illegible] whereas in 1918 only [illegible] accepted

culosis and eliminate cancer there will be far less for the surgeon to do. If women did not have children, if people did not drink, if we could only keep the policeman off his feet, the housemaid off her knees, the miner off his elbows, the aviator out of the air, the boys away from football; if all children in goitrous districts were given a little iodine, there would be less need for the surgeon. But we do not yet live in the Isle of Utopia, and however much the need of the physician may be lessened through the agency of preventive medicine, by eliminating disease as typhoid has been largely eliminated, and yellow fever, and as malaria can and will be, and many nutritional disorders and perhaps goiter, the surgeon will continue to be needed and I cannot see but that he must become a better and better physician.

When physicians acquire a more intimate knowledge of surgery, fewer people in need of operative procedures will be turned over to the surgeon too late, after delays caused by an inordinate number of unnecessary laboratory procedures. When surgeons are required to have a thorough grounding in general medicine before practicing their handicraft, fewer unnecessary operations will be done and many of the evils which exist in their professional relationship with physicians will be eliminated.

All of which has been said as well and much more briefly by Lanfranc: "No one can be a good physician who has no idea of surgical operations, and a surgeon is nothing if ignorant of medicine. In a word, one must be familiar with both departments of Medicine."

THE ANATOMY AND IDENTITY OF "ENCYSTED" AND "INFANTILE" HERNIA

[illegible]

MY first recollection of the terms "encysted" and "infantile" hernia dates back to my [illegible] and more particularly to that well-known chapter on hernia in Gray's *Anatomy*, in which the author illustrates a common scrotal hernia. He proceeds to illustrate four abnormalities of inguinal hernia, namely, congenital hernia, hernia into the funicular process, infantile hernia, and encysted hernia. I studied these illustrations with requisite care, and in due time flattered myself that I had mastered their intricacies. Skepticism as to the correctness of these illustrations was aroused by the fact, that in four of these illustrations, namely, the ordinary scrotal, the congenital, the encysted, and in the hernia into the funicular process, the testis was located posterior to the hernial sac, and that only in the sole remaining one, namely in the infantile hernia, was the testis located in front of the hernial sac.

In the course of time, and more particularly after I had the opportunity to study cases by personal observation, my views began to crystallize themselves. However, when I began to compare the knowledge thus gained upon the operating table with a study of textbooks on embryology and surgery, I was again confused. Finally I arrived at the following conclusions:

1. That the nomenclature of the subject is archaic.

2. That the older observers, such as Hey, who first coined the word "infantile" hernia, and Sir Astley Cooper, who first coined the word "encysted" hernia, while they may have been clear in their conception of the cases, were certainly not clear in their description.

3. That the indefinite statements of these early authors have been perpetuated by subsequent writers; and, as I believe, mostly from a fear of exposing their ignorance.

In a chapter on hernia written for *Johnson's Surgical Therapeusis* in [illegible] I made the following statement:

[illegible] misnomer. Some authors describe a hernia in which the maldevelopment is practically identical with that of an 'encysted' hernia; but the hernial protrusion, instead of becoming invaginated into the preformed lower [illegible] descends behind it; to this form they have applied the vague term 'infantile' hernia. I [illegible] necessity for this subdivision; there is no material difference between the two forms [illegible]."

I had intended to convey that there is no difference between encysted and infantile hernia. A recent incident has led me to believe that there is still confusion in regard to this matter, and it is my present purpose to clarify the subject as far as I am able to do.

[illegible] abnormality of the hernial sac, it will perhaps be [illegible] abnormalities of the hernial sac, as they can all be reduced to a fault in the closure of the processus vaginalis. As is well known the testis in its descent into the scrotum is always accompanied by, or, according to some authors, even preceded by an outgrowth of peritoneum, that has received the name processus vaginalis peritonei. After the descent of the testis has become complete certain retrograde changes occur in this vaginal process; it becomes shut off above at the upper or abdominal end, and below just above the testis; while the intervening portion becomes obliterated, and remains as a fine cordlike structure within the confines of the spermatic cord. The distal portion persists, and becomes the tunica vaginalis testis. The drawing as shown in Figure 1 would therefore represent this condition.

The great frequency of oblique inguinal hernia has led some observers, notably Murray, to the belief, that many (if not all) of these herniæ are due to an imperfect closure of the vaginal process at the upper end, and are [illegible]

this theory is, it falls by the fact, that compared to the number of unafflicted individuals the sum total of persons afflicted with a hernia is after all very small. The majority of surgeons, therefore, assumes that if the involution process is normal, the closure at the lower end occurs just above the testis, while at the upper end it occurs opposite the internal inguinal ring, so that when complete the peritoneum is flush with the abdominal parietes, without any discoverable dimpling.

If a scrotal hernia forms in such a normal case, it follows the direction of the cord, and lies in front of it. It can be illustrated diagrammatically as is seen in Figure 2.

The obliteration of the processus vaginalis as outlined above in brief, is subject to various maldevelopments.

1. CONGENITAL INGUINAL HERNIA

Let us assume the following condition. The testis has descended fully into the bottom of the scrotum, accompanied by the normal processus vaginalis, but at this stage the course of normal development has stopped, i.e. the processus vaginalis has failed to become shut off at both the testicular and abdominal ends, nor has the intervening portion become obliterated (Fig. 3).

It is evident that we are dealing in this case with a complete hernial sac, which communicates above with the general peritoneal cavity. All that is necessary is some unusual effort to force intra-abdominal contents into the hernial sac, in order to form a complete scrotal hernia.

This is the hernia which has received the time honored name "congenital inguinal hernia." That this name is erroneous is self-evident for many reasons. First, because the sac alone is congenital; hernial contents may find their way into the sac before, during, or shortly after birth. On the other hand they may not find their way into the sac until late in life, or never; it is only in this manner that we can account for those cases, which come only late in life, though very soon after the occurrence of a hernial protrusion to operation, at which the presence of the congenital malformation, as above described, is recognized.

Another and perhaps more important reason why the name of "congenital inguinal hernia" is a misnomer, is, that it pre-empts the word "congenital" for this one particular subvariety of congenital hernia, whereas there are a number of other herniæ, which are also congenital, inasmuch as they depend on an antenatal formation.

If the task were assigned to me to rewrite the nomenclature of these malformations, I would have no hesitancy to call this particular subvariety a "hernia into the vaginal process." This name would describe the hernia fully and properly in all detail. Regrettably this name has been erroneously preempted by another subvariety, as will be seen later. The truth, however, remains unequivocal, namely, that this is the only true "hernia into the vaginal process."

The sac of this hernia has certain well-marked characteristics, which differentiate it from an acquired hernia. These are that the sac is very apt to be exceedingly thin, so that its isolation in the course of operation is apt to be much more difficult. Not infrequently there are to be seen ridges and elevations within the lumen of the sac, which are very probably abortive attempts on the part of nature to effect a closure and obliteration.

The principal characteristic of this hernia which stamps it in a class by itself, and which is not present in any other hernia, is, that the testis is within the hernial sac.

2. HERNIA INTO THE FUNICULAR PROCESS

As was just seen, in the "congenital inguinal hernia" so called, the vaginal process of the peritoneum which accompanies the testis in its descent into the scrotum, has become shut off neither at its testicular nor at its abdominal end, nor has the intervening portion become obliterated. Let us now assume a condition in which the vaginal process has become shut off only at its testicular end, and the part in juxtaposition to the testis forms the tunica vaginalis testis; on the other hand, the abdominal end has remained patent, and the intervening portion has not become obliterated. If now intra-abdominal contents find their way into the unobliterated portion of the sac, we have before us a hernia, which, and incidentally also erroneously, has received the

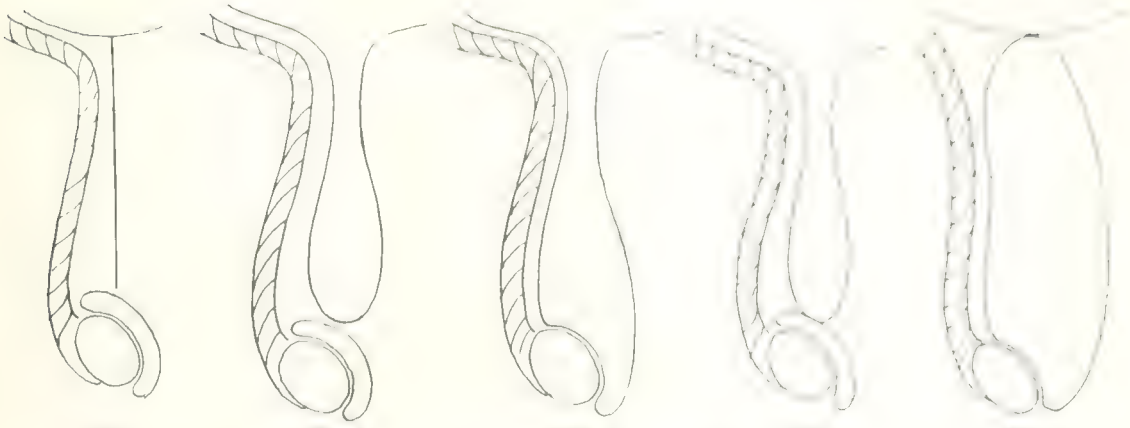

Fig. 1 Fig. 2 Fig. 3 Fig. 4 Fig. 5

Fig. 1. Diagrammatic illustration of a normally descended testis, showing the shut off peritoneum, normal tunica vaginalis and cord remaining after the obliteration of the processus vaginalis.

Fig. 2. An ordinary scrotal hernia.

Fig. 3. [illegible]

Fig. 4. Hernia into the funicular process.

Fig. 5. The [illegible] of an encysted hernia.

name of a "hernia into the funicular process" (Fig. 4).

If this hernia is now compared to an ordinary acquired scrotal hernia (Fig. 2), there is evidently such a striking similarity between the two that it becomes a matter of more than ordinary difficulty to discern any great difference between the two. In fact, the difference is so slight that I have arrived at the conclusion that many cases are overlooked and unrecognized and are classified under the heading of ordinary acquired scrotal hernia.

The differences are the following: (1) Owing to the congenital nature the sac is apt to be exceedingly thin and friable, and on that account extirpated with difficulty. (2) The slender cord which remains behind after the obliteration of the processus vaginalis is absent.

It may now be asked, how can a surgeon recognize a hernia of this nature upon the operating table. A little reflection as to the mode of origin of the sac of this hernia will immediately render it clear, that even though the sac and the tunica vaginalis are two separate cavities, the serosa which makes up these cavities is really one; in other words one cannot be separated from the other without opening into both. I have seen cases of this nature operated upon, and the surgeon ascribed the accidental opening of the tunica to his clumsiness; as the accident is of no consequence no further attention was paid to it, and the case is put down as an ordinary scrotal hernia.

Anatomically speaking the name which is ordinarily given to this hernia, namely, "hernia into the funicular process" is a misnomer. In a strict sense of the word, the hernia vulgo known as the congenital hernia is the only true hernia into the funicular process. I do not know that I can give an accurate name, and one which would be sufficiently descriptive; possibly "hernia into the supratunical vaginal process" may do.

[illegible] ENCYSTED HERNIA

Let us now assume that instead of the distal end, as in the condition just discussed, the proximal end of the processus vaginalis has become shut off, and we will have a condition which can be illustrated diagrammatically as in Figure 5.

The descent of the testis is one of the oldest embryological processes, and has been studied by so many observers, that one would think that all of its stages are well known, and definitely settled. Surprising as it may be, this is far from true. The literature contains many diverging views.

Oscar Frankl (1) studied the subject with great care and analyzed the literature up to his time, and also added the experiences

gained by his own observations and found the following: Camper (2) states that the obliteration of the processus vaginalis begins at the upper pole of the testis, and that it proceeds in an upward direction, up to the internal inguinal ring; Jarjaway (3) states that the obliteration begins at the middle and proceeds in both directions; Fere, that it begins in the region of the external inguinal ring and proceeds both upward and downward; Kocher (4) is inclined to believe that the obliteration begins at the internal ring, and that its progress is in a downward direction; Sachs (5) seems to agree in the main with the views as expressed by Jarjaway. Frankl himself is inclined to accept the theory of Sachs, but in view of the fact, that he has found, that if there exists a complete obliteration at the middle of the processus vaginalis, there is usually also one at the internal inguinal ring, he believes that the obliteration really begins at two places, namely, both in the middle and at the internal ring.

Personally I believe that there is no rule, and that at best we can speak only of a most frequently found method. I base this opinion upon the previously proven facts: (1) that numerous examples exist, at which only the upper end, or only the lower end of the vaginal process has been found shut off; (2) that upon quite a number of occasions I have been able to demonstrate in the sacs of so-called congenital hernia a very definite ring approximately at their middle, somewhat as is illustrated in Figure 6. In fact I have seen three cases in which this raised ring was the cause and seat of a pronounced strangulation. It is even quite possible that the closure can begin at several points; this to my mind is definitely proven by the findings of several so-called hydroceles of the cord in the same individual, and also by the finding of the so-called rosary hernial sacs, which to my mind are only a less advanced stage of the former. As is seen there is a great deal that is merely suggestive about the closure of the vaginal process. One thing is certain, namely, that cases have been recorded in which the vaginal process is shut off only at its upper end and not at its lower, nor has the intervening portion dwindled. I do not know that the condition has ever been dissected and described. On theoretical grounds it is somewhat as I have illustrated it in Figure 5.

Now let us suppose that a hernia forms in a case with this maldevelopment of the processus vaginalis. Try hard as I may I cannot see but that the hernia must come down in front of the cord and vaginal process, and never behind these structures, nor between the two. In other words the hernia can be graphically represented as in Figure 7. It is but proper to mention that as far as I know this condition has never been described, though of course there is no reason whatsoever why it should not exist. The condition, of course, presumes an empty vaginal process or one practically so.

This condition, however, changes at once, if the sac is filled with an exudate, particularly if the exudate is not too excessive. Prior to the existence of a hernia a sort of a congenital hydrocele forms, which is but very little different from a good sized ordinary hydrocele (Fig. 8).

If a hernia now forms a portion of the peritoneum lining the general peritoneal cavity protrudes into the completely shut off serosal sac. It is this hernia which has received the somewhat ambiguous name of "encysted" hernia (Fig. 9).

In operating upon such a case one is surprised, on incising the sac, to find at first no hernial contents; indeed not even a communication with the general peritoneal cavity is found. If this sac is now extirpated (a somewhat difficult procedure at its superior pole), or if the posterior wall is incised, the true sac of the hernia is found bulging into the first sac. If critically examined this hernia resembles in every respect an ordinary acquired inguinal hernia, which happens to be associated with a good sized hydrocele. There is however this one important difference, namely, that the fundus of the hernial sac is densely adherent to the upper part of the hydrocele; as a matter of fact, being one, they cannot be separated from each other.

This is an exceedingly rare variety of hernia, but I have no hesitancy in stating that many cases are overlooked; a not at all surprising matter, when one considers, that, surgically speaking, all the difference between

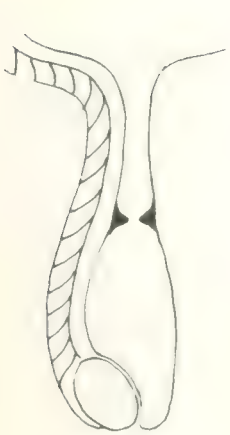

Fig. 6

Fig. 7

Fig. 6. Processus vaginalis with congenital ring formation.

Fig. 7. Hernia in front of an encysted hydrocele.

this rare form and the somewhat more frequent ordinary inguinal hernia, complicated by an ordinary hydrocele of the tunica vaginalis testis, hinges upon the ease or difficulty of separating the two structures. I have personally encountered several cases of the hernia under discussion. I take no especial credit for making the diagnosis, because I am always on the lookout for this possibility whenever I operate upon a large hydrocele, with or without a manifest hernia. It is not impossible that I am in error, for as already stated the criteria upon which I base my diagnosis are only two, viz., an invagination of the hernial sac into a hydrocele sac, and the impossibility to separate the two from each other. I have no hesitancy in stating that this is the hernia which Sir Astley Cooper described under the name of "encysted hernia." One or two of his sentences are not quite clear and lack his usual perfect descriptive style. Cooper (6) writes:

"On opening the tunica vaginalis[1] instead of the intestine being found lying in contact with the testicle, a second bag or sac is seen inclosed in the tunica vaginalis, and enveloping the intestine. This bag is attached to the orifice of the tunica vaginalis, and descends from thence into its cavity.[2] It generally contracts a few adhesions to the tunica vaginalis, while its interior bears the character of a common hernial sac.

"The idea which I have formed of the nature of this variety of hernia is, that the tunica vaginalis, after the descent of the testis, becomes closed opposite the abdominal ring,[3] but remains open above and below. The intestine descends into the upper part, and elongates both the adhesion and tunica vaginalis, so as to form it into the bag, which descending into the tunica vaginalis below the adhesion, and becoming narrow at its neck, though wide at its fundus, receives a portion of the intestine, which in the following case was too large either to be returned into the abdomen, or to retain its function whilst it continued in the sac."

I have purposely copied verbatim Cooper's description of this form of hernia. Barring a few slips of minor importance which are perfectly excusable for the state of knowledge of embryology in his time, there is no doubt that Cooper intended to describe a hernia in which the true hernial sac bulged into a lower hydrocele sac, both of which were adherent, in fact were one.

INFANTILE HERNIA

In the chapter on hernia previously mentioned, I made the following statement in dis-

[1] Cooper evidently [illegible] nia" so-called.

[2] Very vague.

cussing "infantile hernia," which bears repetition.

"The term 'infantile hernia,' is another misnomer. Some authors describe a hernia in which the maldevelopment is practically identical with that of an encysted hernia; but the hernial protrusion, instead of becoming invaginated into the preformed lower sac, descends behind it; to this form they have applied the vague term 'infantile hernia.'"

"I see no necessity for this subdivision; there is no material difference between the two forms of hernia."

I thought I was extremely guarded in my statement, and certainly made no claim of ever having personally encountered one. I confess that when I wrote that article, I had some misgivings whether I made myself perfectly clear. At the same time, I thought a brief mention at least appeared to be justified. Much to my regret even this guarded statement has been misunderstood. I determined to trace once more the term "infantile hernia" to its original source.

Hey (7) used the name "infantile hernia" for the first time in literature. Possibly the name suggested itself to him, because the hernia occurred in an infant of fifteen months, for there is certainly no other plausible reason for having selected it. He describes the hernia as follows:

"I found the tunica vaginalis was continued up to the abdominal ring, and inclosed the hernial sac; adhering to that sac, by a loose cellular substance, from the ring to within one-half inch of its inferior extremity . . . .[1] The interior or true hernial sac was a production of the peritoneum as usual and contained only the cæcum or head of colon . . . . Having removed the proper hernial sac I examined the posterior part of the exterior sac; and found it connected with the spermatic vessels in the same manner as the tunica vaginalis is, when the testis has descended into the scrotum."

Hey then goes on to describe the process of the normal descent of the testis, and finishes with a description of what he considers to be the true pathological explanation of the occurrence of such a hernia. As it is of some importance, and in order to settle the question, I may be permitted to copy his explanation verbatim. It is as follows:

"In the hernia which I am describing, the intestine was protruded after the aperture in the abdomen was closed; and, therefore, the peritoneum was carried down along with the intestine and formed the hernial sac. It is evident also that the hernia must have been produced while the original tunica vaginalis remained in the form of a bag as high as the abdominal ring, on which account that tunic would receive the hernial sac with its included intestine, and permit the sac to come into contact with the testicle." (In other words, Hey describes an encysted hernia, but he spoils it all by adding another sentence, which renders his idea and observation most difficult to understand—unless by the word "contact" he means proximity but not actual contact.)

The points of greatest importance in this description of hernia are the following: (1) that Hey called this hernia, and used for the first time the words "infantile hernia" (I have already pointed out that the term is a bad one; that it does not mean anything; that perhaps Hey used it because he encountered it in an infant); (2) that Hey practically describes the same kind of hernia as Cooper described; (3) that Hey antedates Cooper in the discovery and accurate description of this hernia by several years.

As a sort of commentary of the above I have attempted to see what later writers had to say upon the subject, but have finally arrived at the conclusion that it would only tend to confuse the topic still more.

[1] Vague.

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LEVATOR HERNIA (PUDENDAL HERNIA

Report of a Case Operated Upon by Combined Route [illegible] Previously Reported Cases

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IN consideration of the extreme rarity of this condition, its little understood anatomical and pathological features, and the consistent failure of all operative measures for its cure in the past, I feel that sufficient interest exists to warrant my early publication of this case, although only a year has elapsed since operation—too short an interval, of course, to speak of a cure.

Definition and Classification

Pudendal hernia, as the name implies, is a hernia located in the pudendum. The term is misleading because other types of herniæ, inguinal, etc., may also have their termination there. Contrary to the usual rule, the final resting place of the hernia, instead of its exit, determines its name, which is further misleading. Von Winckel has suggested the descriptive term "subpubic hernia." As the essential anatomical feature is a rent in the levator muscle and its fascia (and adhering to the rule of naming herniæ in reference to the point of exit), we believe the term "levator hernia" as suggested by Blake to be the most appropriate.

Further classifications and subdivisions have been attempted leading to greater confusion. Some have stated that herniæ, having their point of exit behind the broad ligament, should be called "perineal herniæ." This is obviously wrong, because, although piercing the levator behind the broad ligament, the hernia may, in passing forward under the broad ligament, carry bladder with it as a part of the sac and still emerge in the labium above the transversus perinei muscles as in my case. Furthermore, a hernia anterior to the broad ligament, may break away the transversus perinei muscle at its point of exit and appear at the perineum, the transversus perinei muscle being the acknowledged boundary line between pudendal or subpubic herniæ above and perineal herniæ below. (Patient in dorsal position.)

Where all this confusion exists it would seem timely to suggest a classification and nomenclature based on the anatomy, which would give a clear indication of the exact site and structures involved. Therefore the following classification is suggested, including under the broad term "levator hernia" all the subclasses, because as stated above the essential feature—point of exit of all these herniæ—is the levator muscle and [illegible].

Levator hernia

1. Congenital
   a. Anterior to broad ligament
   b. Posterior to broad ligament
   c. Combined (anterior and posterior)
2. Acquired
   a. Anterior to the broad ligament
   b. Posterior to the broad ligament
   c. Combined (anterior and posterior).

Historical

Pudendal hernia is a condition of extreme rarity; the case which I am about to report being the thirteenth in literature.

It has always been considered incurable and of the thirteen reported cases, attempts at operative relief have been undertaken in only five. Only one has been reported cured (Case 12—Grattan). One case (Moschcowitz Case 11) had seven major and many minor operations without relief.

To Sir Astley Cooper is usually ascribed priority in reporting cases of this type of hernia. However, he was preceded by Méry, who in 1739 reported in the *Transactions of the Royal Academy of Sciences*, of Paris, the following case:

Case [illegible] Reported by Méry. The [illegible] was found to be formed of a [illegible] given. It was somewhat larger than an egg [illegible] disappeared on compression. The contents were evidently bladder. The description of this case is not sufficient to differentiate it from ordinary vaginal cystocele. It is, however, included in von Winckel's list of pudendal herniæ.

Case 2. Reported by Curade. Cooper was also preceded by Curade, who in 1760, in the *Transactions of the Academy of Surgery* of Paris, reported the following case. The patient was a female of 26 years of age and was 6 months pregnant. On examination a lateral perineal tumor was found which increased in size on standing, or when the patient refrained from urinating for a long time. It was soft and painless. When compressed manually there arose a desire to urinate, and if pressure was continued, urine was actually pressed out. After confinement the hernia disappeared but returned in a subsequent pregnancy.

Curade states that he has no doubt that the case was one of pudendal hernia. The description of the physical signs and findings are so accurate, and all point so strongly toward an involvement of the bladder, that I believe that there is not the slightest doubt that this case can be placed in the list of true pudendal herniæ.

Nevertheless it is Sir Astley Cooper to whom we are indebted for the first detailed and complete reports of this rare condition. In his excellent monograph on herniæ, published in London 1807, he reported the two following cases:

Case 3. Reported by Cooper. This case was a female, age 22, who had a hernia the size of a pigeon's egg for a long time and which she had always been able to reduce. When Cooper saw the patient, he found a swelling situated below the middle of the left labium, while the upper part of the labium and the inguinal ring were free from any swelling. The tumor extended upward alongside of the vagina nearly as far as the uterine os. The hernia gave an impulse on coughing. Cooper succeeded in reducing the hernia by taxis. In doing so the hernia disappeared upward with a gurgling noise and relief of all symptoms. After reduction of the contents the labium was flaccid, and a finger introduced into this flaccid sac could be passed upward into a circular orifice on the inner side of the ischium, between it and the vagina. Subsequently a "T" binder was used to retain the hernia.

(The above is a verbatim copy of the history from Cooper—in spite of the brevity of the report there is not the slightest doubt that this is a true case of pudendal hernia. It is to be regretted that the anatomy of the hernial ring is not described in detail.)

Case 4. Reported by Cooper. This case is merely mentioned in connection with Case 3—the report of same is even shorter. Female, age not given, who had a swelling similar to but smaller than the preceding, and situated in the right labium. It disappeared in the recumbent posture, but reappeared promptly when the patient stood up. Dilated on coughing.

Chronologically the next case reported is that of a contemporary of Cooper—Cloquet—a surgeon who has written extensively on the subject of hernia.

Case 5. Reported by Cloquet. Under the title "*Sur une hernie vulvaire*" this author publishes the following case: Female, age 24, complained of a swelling in the vulva. On examination, Cloquet found in the posterior part of the right labium majus, a round swelling the size of a large chestnut, which stretched the overlying skin and also extended toward the inner surface of the external genital. The swelling was slightly tender and extended upward alongside of the vagina; it became much more tense on standing and coughing and gradually increased in size. The patient noticed the swelling for the first time, only 14 days previously, and she believes that it was caused by straining at her work and at stool. Cloquet was able to reduce the swelling by taxis, the reduction being accompanied by a gurgling sound. After reduction a finger could be invaginated into the labium, whereupon a rounded opening was noticed between the vagina and ramus of the ischium. Nothing further was done but the patient immediately felt relief of her symptoms, nor has the hernia recurred since.

Case 6. Reported by Hartmann. This operator reports that he has performed an autopsy upon the body of a female who had suffered for a long time with symptoms of a vesical calculus. At the autopsy there was found a tumor in the labium, which was formed by a portion of the prolapsed bladder. (It is to be regretted that the exact autopsy findings are lacking in this case; on that account it is very difficult to differentiate it with precision from ordinary cystocele.)

Case 7. Reported by Hager. This surgeon, under the caption "*Vorderer Mittelfleischbruch bei einem Weibe,*" describes the following case:—The patient was a female, age 28. During her first confinement, which was very difficult, the patient noticed in the middle of her right labium majus, a swelling the size of a walnut. It decreased in size in the recumbent posture, but became larger on standing or walking; it was easily replaced but reappeared promptly. The swelling increased slowly in size during the subsequent 4 years, and then increased suddenly, became painful and softer. Poultices were applied, whereupon the swelling opened spontaneously at two points, discharged a quantity of blackish fluid and decreased in size. Seven months later in the course of a second pregnancy, the swelling became more annoying, on which account the patient entered Hager's clinic. At the examination, there was found a swelling the size of a pigeon's egg which occupied the right labium majus. The labium majus had disappeared by being stretched over the tumor. The vagina was pushed over to the opposite side by the pedicle of the swelling which passed upward between the vagina and ascending ramus of the ischium. The swelling was very tense and elastic and both painful

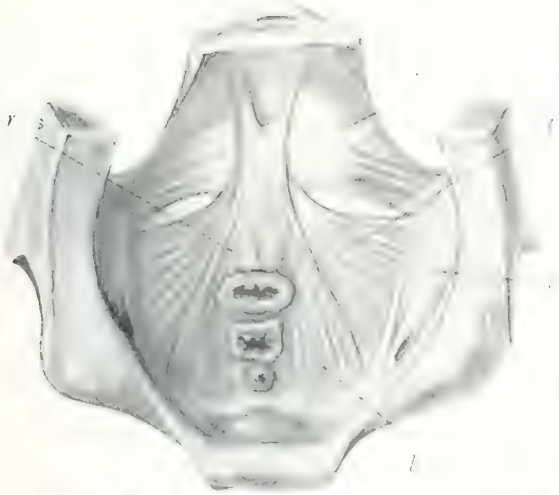


Fig. 1. Showing the weak points in the pelvic [illegible] above the beginning of levator hernia internals. 2. Recto-coccygeus; 3, coccygeus; 4, levator ani, and 5 obturator fascia.

and tender. Hager diagnosed an anterior perineal hernia (pudendal) which was inflamed and also mildly incarcerated. Under local treatment these symptoms disappeared and finally the patient was discharged just prior to full term delivery.

Case 8. Reported by Koenig. Speaking of pelvic herniæ, this author says that the most frequent forms are those which descend alongside of the vagina in front of the transversus perinei and then make their appearance upon the surface in the labium majus. He saw one such case which had the size of a man's head—detailed description is not given.

Case 9. Reported by von Winckel. In this case the patient was a female who had been confined a number of times; all deliveries were difficult; the last time forceps had been used. Even prior to this last confinement the patient noticed a swelling in the right labium majus. Upon the mesial surface of this swelling another smaller swelling formed, which also increased in size and made quite a projection. On examination a swelling larger than an adult's fist was seen occupying the vulva, and more particularly occupying the part of the right labium majus. It was situated anteriorly and to the right of the perineal body and was bounded externally by the tuberosity of the ischium, and anteriorly by the right half of the symphysis pubis. Even on casual inspection it was seen that the swelling was made up of two different parts; namely, an outer one belonging to the labium and an inner one belonging to the introitus. On careful examination the smaller inner swelling was recognized to be the everted bartholinian gland. In the larger portion, or hernia proper, various structures could be palpated. By manipulation and pressure along the right side of the vagina, most of the hernial contents could be replaced into the pelvis; one smaller body, which was taken to be

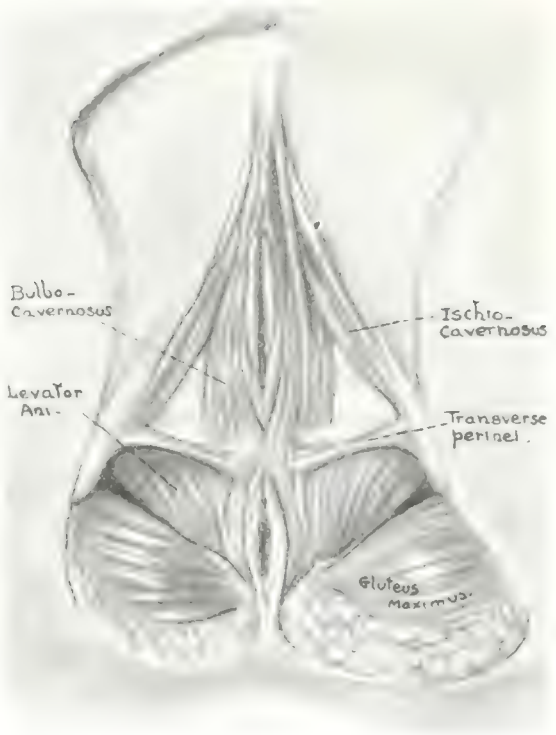


Fig. 2. Showing the "subpubic" triangle and its boundaries through which all the [illegible]

the ovary, could not be replaced. Treatment with a pessary and a truss was tried but was absolutely unsuccessful. Von Winckel, therefore, tried a plastic operation *per vaginam*, which was followed by slight improvement, but failed as a cure.

Von Winckel reviewed the published cases of pudendal herniæ and reports the following additional one:

Case 10. Reported by von Winckel. This patient was a female, age 31, after being in labor for 3 days, and after many attempts of delivery with forceps, she was delivered by perforation. At the age of 2 years, she noticed accidentally, a swelling in the right labium which gave rise to very few symptoms in the beginning, but to many subsequently. The swelling was reducible, and when reduced, an opening could be palpated underneath the symphysis. Von Winckel made many attempts to treat the patient with a truss, but without avail, and in consequence he decided to operate. The operation was carried out in the following manner:

Through a median laparotomy it was ascertained that the intestines were so adherent to the sac that they could not be liberated; therefore, the proposed closure of the sac from within the abdomen was abandoned and a ventral fixation of the uterus per-

Fig. 3. Showing Case 11 (Moschcowitz). Published through courtesy of Dr. A. V. Moschcowitz and Dr. George Gray Ward, Jr.

formed as a substitute. For a short while the condition was improved somewhat, but a recurrence followed very soon and the patient was operated upon a second time. At this operation the sac was split up from below, the contents were reduced and the sac obliterated by suture. The patient was greatly improved by this operation but not cured completely. A small hernia still remained which grew only slightly during the next 15 years

Case 11. Reported by Moschcowitz—(verbatim copy of report by Moschcowitz). Mrs. E. L., age 41, history prior to 1895 is irrelevant. Delivered by forceps at termination of first pregnancy November 18, 1895. Indication for forceps not evident—pelvis ample size. Shortly after delivery a mass protruded from the vagina and coincidentally with it an incontinence of the bladder was also noted. The condition was first looked upon as one of paralysis of the bladder and a good prognosis was given. The condition, however, did not improve and after being seen by a large number of consultants, she finally came under the care of Dr. F. Lange, formerly of this city, who diagnosed for the first time a "Vaginal Rupture of the Bladder" with complete loss of the urethra and also an ununited fracture of the left pubic bone. Since that time the patient was operated upon a number of times. Only the operations of a major nature are mentioned here. The first major operation was undertaken December 30, 1895, and surprisingly was perhaps the one followed by the greatest amount of success. It consisted of a closure of the defects of the bladder and the formation of a new urethra of the left labium minus. After this operation patient regained control of the bladder.

The second major operation was undertaken May 10, 1896. The previously mentioned vaginal protrusion, which the operator recognized as a hernia, was pushed back and the opening closed by some sort of a vaginal plastic. This operation was not in the least successful; the hernial protrusion recurred immediately, whereupon the patient was informed that before another attempt at its radical cure could be made, it would be absolutely necessary first to repair the fracture of the pubis.

The third major operation was therefore undertaken in January, 1897. The patient was told that the ends of the fractured pubic bone were refreshened and sutured with silver wire. Unfortunately the wound became infected and had to be reopened. Intractable sinuses formed throughout the length of the incision until the silver sutures were removed about 6 months later; at the same time another unsuccessful attempt was made to cure the hernia by a vaginal operation. This may, therefore, be called the fourth operation.

A fifth unsuccessful attempt at a cure was undertaken in June, 1899.

Thereafter the patient abandoned all hope at a cure for 9 years.

In 1918 the patient again became pregnant and was delivered prematurely by a breech presentation. After this confinement the hernia increased marked-

ly in size; it also became evident, for the first time, that the hernia contained not only the bladder but also intestines. The patient was a total invalid; she became bed-ridden and suffered a great deal of pain and untold inconvenience from the hernial protrusion; a particularly annoying symptom was the inability to empty her bladder unless she first reduced the hernia manually.

She therefore readily consented to a sixth attempt at a cure, which was undertaken March [illegible] by Dr. Robert Abbe, to whom I am indebted for the following notes: This operation was the first attempt at a cure by the abdominal route. The hernia in the depth of the pelvis was exposed; its contents were found to be the bladder and about [illegible] of small intestines. These as well as the hernial sac were drawn back, and after putting the sac on the stretch to the utmost, the opening was repaired by a sort of cystopexy, the bladder being fixed by six sutures of Pagenstecher linen to the peritoneum and fascia of the anterior abdominal wall. For a while this seemed to fulfill the intended design; however, soon after the patient was permitted to be up and about the condition recurred.

I saw that patient for the first time May [illegible]. My physical examination revealed the following status: A well-healed median abdominal scar. A protrusion in the left labium, about the size of an adult fist was noted; this protrusion was dull on percussion and imparted an impression of translucency; it was reducible, but upon the slightest attempts at reduction the patient felt an uncontrollable desire to urinate. The swelling was so large that its mesial surface, having pulled the vagina down, was covered with mucous membrane. The introitus vaginæ was crescentic, with the convexity toward the right. The left labium minus was absent (result of previous operation). The vestibule of the vagina was so distorted that at first I was entirely unable to find any urethra; finally after a great deal of search I was able to discern an orifice, or better said, the opening of a fistulous tract high up, hidden underneath the symphysis which on probing led in a tortuous manner upward and to the left into the bladder. Entire vagina was occupied by a protrusion which came down along into left side. When the mass was reduced there was to be felt to the right side of the descending ramus of the pubis a longitudinal hiatus, easily admitting four fingers. The internal organs were negative to palpation.

The history and physical findings were not very encouraging for a radical cure. The patient, however, was so willing and even insisting, that I finally acquiesced to her pleadings and consented to make another attempt in a manner not hitherto tried.

This operation was performed May 27, 1913. Median laparotomy extending from the symphysis pubis to one inch above the umbilicus. Massive adhesions were encountered at the site of the last operation. After liberating the adhesions it was seen that the hernia was of the sliding variety, involving the left half of the bladder. This was very discouraging because at the very outset it prevented me from at least extirpating in a thorough manner the hernial sac as I hoped to do. The small intestines were adherent in the depth of the sac and were freed.

[illegible] that its internal surface is covered with mucous membrane and external surface [illegible]

The hernial ring was a large, irregular oval, easily admitting the folded hand, and was bounded [illegible] ternally by the ascending ramus of the pubis [illegible] mesially by the soft tissues of the bladder, uterus, and vagina. The problem of a cure, therefore, resolved itself into the question of [illegible] this opening. Neither pelvic fascia nor levator ani were [illegible]. I believe both were [illegible] ever at the original forceps delivery. I, therefore, deliberately carried out an operation I had planned in advance, namely to dislocate the uterus and to use it as a plug for the hernial opening.

In order to enable me to do so, I first extirpated the right ovary and both tubes. After [illegible] pelvic peritoneum, [illegible] the uterus was dislocated into an extreme sinistro version and fastened in its new position with a number of Pagenstecher sutures to the descending ramus of the pubis. Had the uterus been only a trifle larger, or the hernial ring only a trifle smaller, it would have been possible to [illegible]

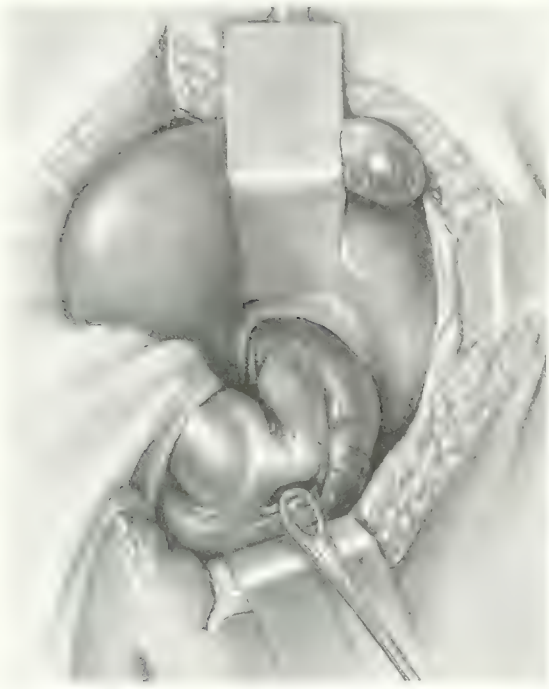


Fig. 5. Abdominal route. Showing the pregnant uterus displaced to left and loop of sigmoid piercing right broad ligament. Dotted lines indicate knuckle of bowel pulled up from sac; median incision seen from above and behind uterus.

completely; as it was the lateral portions only could be obliterated, and no matter what I did there still remained a weak area to the right of the dislocated uterus which could not be closed. The best I could do under the circumstances was to pull up the vagina and bladder and suture these organs to the dislocated uterus. The duration of the operation was 2 hours. The convalescence was exceedingly stormy. The patient vomited almost continually for a number of days. Temperature and pulse, however, remained normal. Primary union resulted and the patient was discharged June 19, 1913.

I kept the patient under observation and for some time after the operation she was very comfortable. However, about one year after the operation, I found on examination, that the uterus was again in its normal vertical position—no more sinistroverted and that there was again a hernial bulging. I heard from the patient the last time just one year ago, at which time the hernia had recurred to practically its former dimensions.

Case 12. Reported by Grattan. (Verbatim copy as published by Grattan.) Mrs. M. F., age 53, came to me in July, 1918, for relief of the condition which she described as "irritation in the rectum with difficulty in moving the bowels and in addition a bearing down sensation in the vagina," ascribed by two physicians, who had examined her within a year, to falling of the womb. The rectal trouble was further described as "a desire to empty the bowels often quite urgent but without result except with the aid of an enema."

The inception for this trouble dated back 4 or 5 years, but remained quite tolerable to within a few months preceding her first visit, when the attacks increased in frequency and severity causing considerable worries and discomfort. She had never noted any blood in the stools. She added that her brother had died recently following an operation for cancer of the rectum. Naturally, I ascribed her concern to the recent family loss but decided to use the proctoscope as a part of the physical examination.

The marital history showed three pregnancies including a difficult twin delivery with loss of one of the twins as a result of a protracted labor. Patient had always done hard physical work about the house through necessity. The condition mentioned as falling of the womb was regarded by the patient as the usual legacy of a hard working mother of several children, but the rectal trouble caused her real concern.

Physical examination. General survey - an obese type woman of middle age, height about 5 feet, 4 inches, color slightly cyanotic, facies slightly suggestive of a nephritic condition. Slight dyspnœa on exertion. Thyroid, heart, lungs and extremities show nothing of interest. Abdomen pendulous—no umbilical, femoral, or inguinal hernia. Urine shows faint trace of albumin. Local examination—vaginal examination showed nothing unusual except it be the well-retained vaginal walls without a suggestion of cystocele or rectocele, and a small well-located uterus—all of which argued against prejudice created by the history in favor of a prolapse of the uterus. The cervix was small and normal; vulva normal. Digital examination of the rectum was negative. There was no prolapse; no hæmorrhoids; proctoscopy revealed nothing to account for the symptoms.

I decided to reassure myself by repeating the vaginal examination. With the examining fingers of the right hand in the vagina, I told the patient to hold her breath and strain downward—nothing happened. I asked her to cough several times. All these procedures failed to cause any perceptible descent of the uterus; but as she repeated the cough I thought I felt an impulse against the back of my examining hand. I had her repeat the cough ten or twelve times. As she did so I observed and felt a definite impulse in the adductor region of the left side. A mass the size of a hen's egg developed at the site of the impulse. The mass was soft, reducible, and gurgling occurred on manipulation. The location was crescentic area external to the left labium majus, but not involving that part. The gurgling, the definite impulse on coughing and the reducibility upward of the mass satisfied me that I had found a hernia containing intestine in an unusual location. Patient complained that my manipulations reproduced to some degree the symptoms referable to the

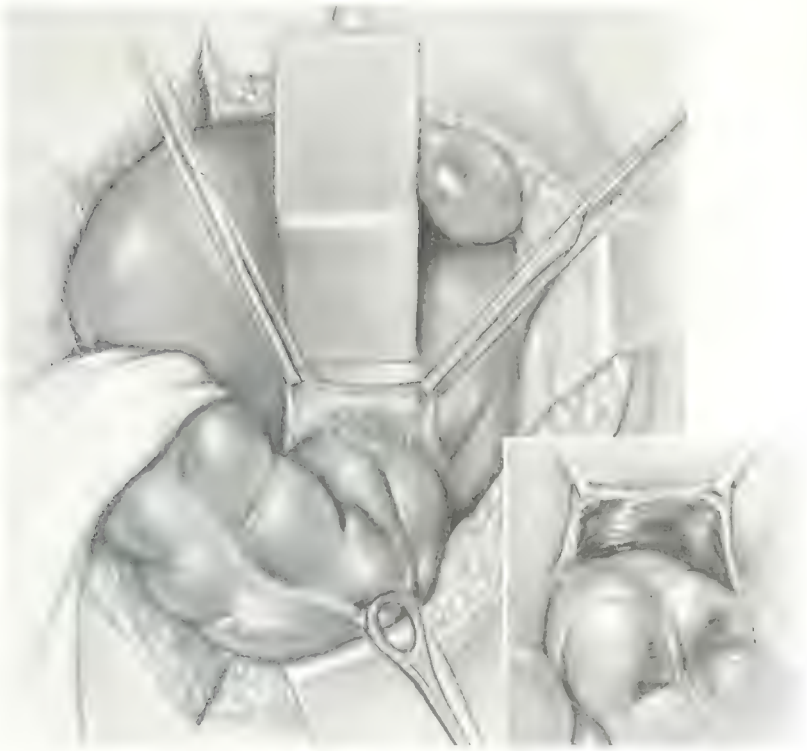


Fig. 6. Abdominal route. Showing the sac pulled up partly after reduction of loop by traction. Insert shows peritoneal edges of sac held up with tenaculum showing below after circumcision of margins as indicated by dotted line in large picture.

rectum, and also gave the sense of bearing down formerly ascribed to falling of the womb. To repeat I knew that she had a hernia but to explain its course of descent was a real problem. In a general way I argued that it must have emerged through some rent in the pelvic floor, occasioned by muscular separation during the difficult twin labor. I hoped that exploration would throw further light on the true anatomy of the condition.

Operation. Seeing no advantage to approaching from below and feeling that I would loose my landmarks in following the sac from below upward, I chose the abdominal route. A suprapubic incision extending from the symphysis to the umbilicus was necessary on account of the extremely fat abdominal wall. The exposure of the pelvis was difficult because of the great amount of intra-abdominal fat and the risk of the exaggerated Trendelenburg position with an adipose subject. Exposure of the pelvic organs finally revealed descent of the sigmoid loop to a triangular opening in the floor of the pelvis. This opening was bounded anteriorly by the posterior reflexion of the left uterosacral ligament; laterally and posteriorly by the rectum. The sigmoid being fixed at its point of continuation into the rectum appeared to slide down along the posterior surface of the broad ligament and disappear through the hernial opening. Practically the entire loop was out of view. Much to my surprise gentle traction brought the entire sigmoid loop out of the sac. There were no surface adhesions and no evidences of constriction at any point. The opening was triangular in outline, with the uterosacral ligament forming the base, the reflexion of the broad ligament the anterior arm and the rectum (in an irregular sense) the posterior arm of the triangle. I inserted my left index and middle finger downward into the sac and had the nurse uncover the inner side of the left thigh, and identify the fingers through the skin covering the sac. There was no process of the sac descending into the left labium as in the cases of pudendal hernia reviewed by Moschcowitz. However, the exit and course of the descent was undoubtedly the same the final destination being the subcutaneous tissue of the upper adductor region of the thigh rather than the labium.

Gross surgical anatomy. The protrusion undoubtedly occurred through a rent in the levator ani muscle and passed through the triangle, bounded externally by the ischiocavernosus, internally by the constrictor cunni and posteriorly by the transversus perinei, and along the left lateral wall of the vagina

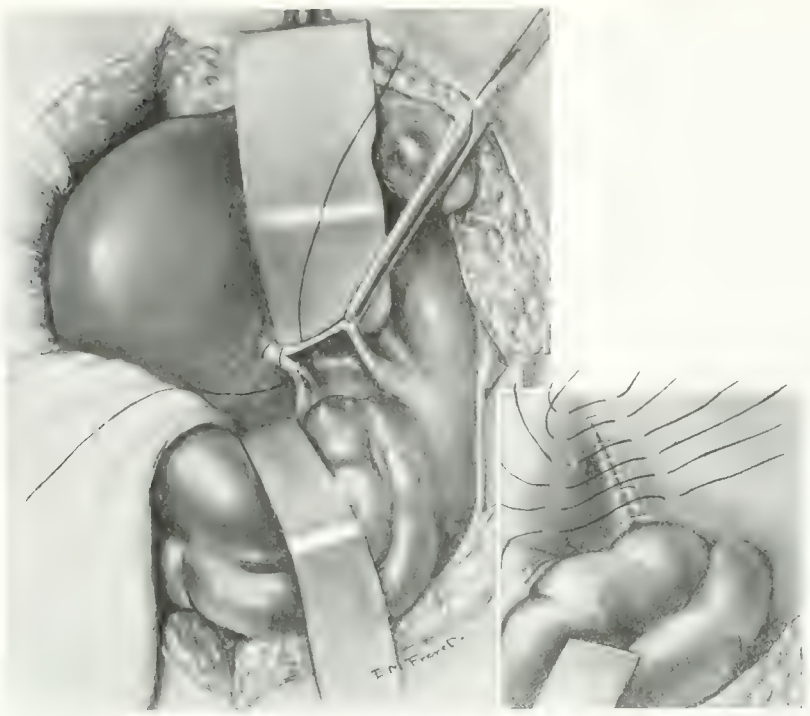


Fig. 7. Abdominal route. Showing the fascial closure (rectovesical—true pelvic fascia) beneath peritoneum. Peritoneal edges not well shown above fascial split. Insert shows second row of sutures of peritoneum, unfolding the fascial layer.

emerging in the thigh. The split of the levator was probably the result of the difficult twin labor mentioned in the history. The rectal symptoms were undoubtedly due to the partial kink produced at the rectosigmoid junction when the sigmoid loop descended into the sac. The bearing-down feeling was a natural accompaniment of the hernia. The ready extraction of the sigmoid from the sac at the operation explained the spontaneous reducibility and freedom from symptoms in the intervals.

Closure of the ring. Needless to say no attempt was made at extirpation of the sac. Its depth, adipose status of the patient, her age, as an argument against prolonging the anæsthetic needlessly precluded this. With great effort and difficulty I passed five or six mattress sutures of double Pagenstecher linen across the long arms of the triangle and succeeded in closing it tightly and completely. To make doubly sure I whipped a continuous suture over the line of mattress suture taking another reef in the broad ligament. This last step caused a version of the uterus backward and to the left, superimposing the fundus over the site of the hernial opening. The sigmoid was anchored to the left psoas muscle, the brim of the pelvis and again about 2 inches above that point, the idea being to prevent its descending to its habitual location in the vicinity of the hernial opening. The abdomen was closed by layer sutures. The patient made an uneventful recovery. Mineral oil was used for 6 months following the operation to secure daily evacuation. This is not necessary at present. The sense of prolapse and rectal irritation have never been experienced since the patient left the hospital. Two years have elapsed and repeated examinations failed to show recurrence.

Epicrisis. While the point of entrance (or internal ring) of the hernia was evidently the same as that of a pudendal hernia there is nothing further to demonstrate the variety. The point of exit was not demonstrated nor was the exact position of the sac. The fact that it apparently did not involve the labium would lead one to believe that the point of exit was behind or posterior to the transversus perinei from whence it dissected up the adductor region of the thigh. In other words there is apparently nothing which definitely distinguishes it from the more common perineal herniæ. A true pudendal hernia must emerge through the subpubic triangle, must involve the posterior part of the labium, and must be covered mesially by vaginal mucosa and externally by integument.

Through the courtesy of Dr. George Gray Ward, Jr., chief surgeon of the Woman's

Hospital, in whose service the following case was operated upon by me. I will add to the twelve cases previously reported the thirteenth, as follows:

Mrs. H. A., Woman's Hospital. History No. 26006, admitted December 6, 1920; discharged February 2, 1921. Chief complaints: (1) Pain of bearing-down character in lower right quadrant of abdomen; (2) bearing-down feeling in the right labium and vagina; (3) sense of pressure and bearing-down feeling in rectum and in bladder when coughing, straining, etc.; (4) a feeling as if everything is dropping out and has to hold hand over right side of perineum when straining at stool, during urination, etc.

The family history is negative. Patient has had no illnesses, except diseases of childhood. Menstruation began at 15, always regular, 28-day type, lasting 3 days, moderate flow, no pain. Married 16 years, six children, three miscarriages, all spontaneous at about third or fourth month. Oldest child 14 years, youngest 17 months. All normal deliveries except the last which was a forceps delivery and patient [illegible] labor 28 hours.

Present Symptoms. Twenty-one months ago, when patient was 4 months pregnant, while working in a mill, felt sudden sharp pain in lower right quadrant, and in vagina and rectum, with bearing-down [illegible] tion, as if wanted to move bowels and could not. Pain became severe in half an hour and she was taken home, given some pills and a hypodermic and put to bed. Vomited the medicine and continued to vomit daily for a week, with continuous pain, slight fever, bearing-down sensation and could not get bowels to move. Markedly distended for a week. Given enemata and cathartics daily and finally bowels moved on the seventh day. At the onset of the pain the bulging of the vagina was noticed for the first time, and has remained since but seemed larger during the attack. Throughout the remaining 5 months of her pregnancy, the bulging was a constant annoyance and had to be held with the hand when straining at stool, urinating, etc. When labor started in at term the bulging became larger, and after the membranes ruptured, and the head came downward with each contraction, the lump got bigger and pain more intense; and then receded with the abeyance of each pain. Also vomiting was constant throughout the labor. The doctor came and tried to push the mass above the baby's head, but could not and gave her chloroform after summoning another doctor to help, and used forceps. This took [illegible] hours. The child was normal, weighing 8¼ pounds. Patient was in bed for two weeks.

After delivery no vomiting or fever occurred, but the rupture got bigger and had to be held with the hand on straining, and bowel movements and urination were very painful. Since then the bulge has gradually gotten bigger requiring holding with each defæcation and urination.

[illegible]

Physical examination. A general survey shows a rather obese, well-developed young woman of [illegible] color. Height [illegible] feet [illegible] inches, [illegible] pounds. Heart and lung normal. Labor-abdominal [illegible] lous, otherwise negative. No umbilical, inguinal, or femoral herniæ.

Local examination. A protrusion was seen in the posterior part of the right labium, the size [illegible] adult fist. It was semi-resonant to percussion, easily reducible, with an impulse on coughing. On attempts at reduction the patient felt a sense of pressure high in the rectum and a desire to urinate. When the mass bulged on coughing or straining, its [illegible] surface was covered with mucous membrane of the vagina, and its external or right surface with integument, and the mass occupied the posterior half of the right labium. The vagina was crescentic with convexity toward the left. On straining the entire vagina was occupied by [illegible] and [illegible] toward on the right side parallel with the vagina. When the mass was reduced the labium was left flaccid and redundant, and passing the fingers upward and inward through the flaccid labium, along the right [illegible] of the [illegible] ovoidal hiatus, could be felt on the right side of the vagina, bounded mesially by vagina and externally by the [illegible]

Fig. 9. Vaginal route. Showing the condition several weeks after completion of the abdominal operation. No evidence of hernia, normal parous vagina, primary incision.

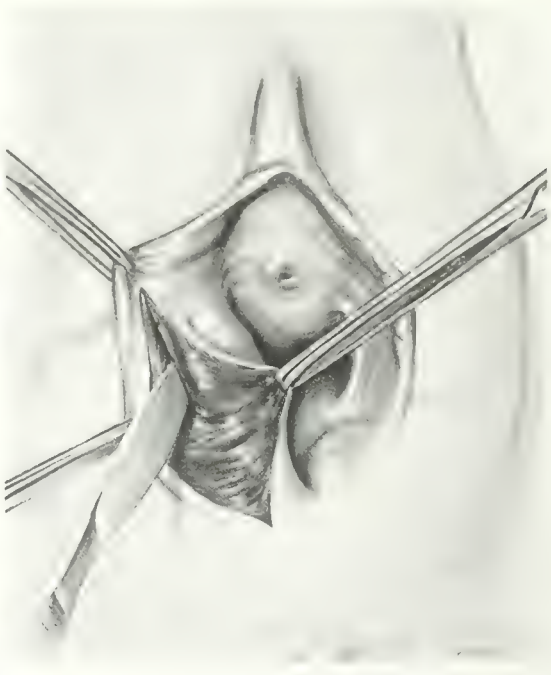


Fig. 10. Vaginal route. The dissection continued—separation of vaginal flap to expose subpubic triangle on the right side.

ing admitted four fingers which could be easily passed through it, palpating the pelvic organs on the right side. A curved sound passed into the bladder showed no cystocele, but the sound passed outward and downward could be brought through the hiatus and felt in the bulging sac. With the hernia reduced, proctoscopy was negative as was also digital examination of the rectum. With the finger of one hand in the rectum and the finger of the other hand in the vagina, the mass could be felt on straining to come down the right lateral wall of the vagina between the two examining fingers. The pelvic organs were otherwise negative except uterine pregnancy at third month, moderate laceration of perineum and bilateral laceration of cervix. No rectocele or cystocele.

Operation. The diagnosis of pudendal hernia having been made, it was determined after consultation, that a therapeutic abortion should be done because of the strangulation of the hernia during the last labor, the fact that the patient had six living children, and further because we felt that this serious type of hernia, hitherto always regarded as incurable, should not be operated upon so close to the expected labor. Accordingly it was planned that the operation be undertaken in two stages: first, the therapeutic abortion and the operation by the abdominal route for reduction of the contents and closure of the ring; second, operation by the vaginal route for removal of the sac and plastic repair of the levator, fasciæ, etc.

Stage 1, abdominal route. Dilatation and curettage; salpingectomy, bilateral (sterilization); closure of hernial ring; sigmoidopexy.

Findings and operation. Examination under ether shows, when the patient is straining, a mass the size of a man's fist, bulging into the vagina on the right side, occupying the posterior part of the right labium. After curettage was performed and the usual products of conception of the third month removed, the uterus was packed with iodine gauze. The abdomen was then opened by a median suprapubic incision 5 inches long. The pelvic loop of the sigmoid was found to be very mobile, with mesosigmoid 7 or 8 inches long, the entire sigmoid loop being in the pelvis and the only fixed point being the recto-sigmoidal junction at the end of the mesentery. The sigmoid loop, by sliding with its mesentery and the upper portion of the rectum, had pushed forward and slightly to the right, behind and underneath the right broad ligament, at the junction of the right broad ligament and the cervix, just external to the junction of cervix and right sacro-uterine ligament. At this point, where there is normally a slight fossa, bounded mesially and internally by the right sacro-uterine ligament and anteriorly by the base of the right broad ligament, and externally to complete an imaginary triangle by a line drawn between these two points, the knuckle of bowel had, after partially tearing away the anterior end of the right sacro-uterine ligament, pushed forward and downward,

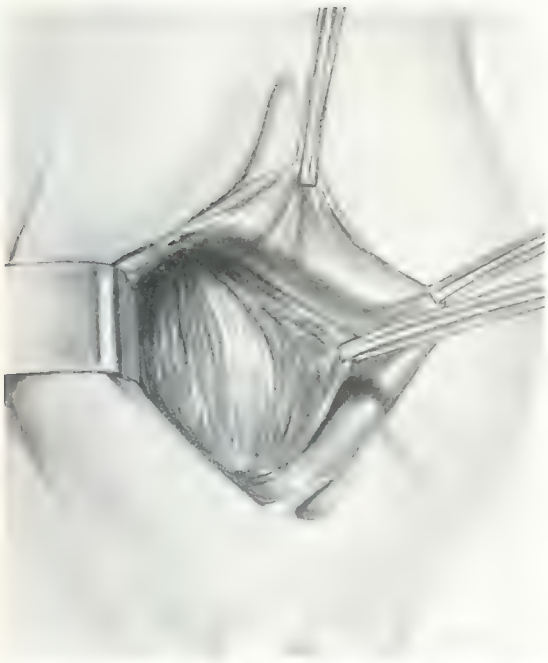


Fig. 11. Vaginal route. Showing the right levator muscle drawn over toward left and sac (now empty and not bulging) showing through split levator. Light area [illegible] showing through split in muscle.

Fig. 12. Vaginal route. The sac has been separated from edges of split levator, and the inner bundle of split muscle [illegible] and sac freed to neck. Specimen [illegible]

tearing a hole in the rectovesical fascia, which would easily admit three fingers. The loop of bowel having been lifted from this canal, two fingers were passed forward through the opening, under the right broad ligament forward and downward, when it was ascertained that the bladder (inferior and right lateral surface) remained in the canal. The bladder was then drawn up out of the sac and my assistant, passing two fingers through the vagina into the hiatus brought his fingers into contact with my fingers above. I then had him attempt to turn the sac into the abdomen by pushing upward from below. The sac was adherent and this could not be done and after a few attempts this was abandoned, for we soon realized that the opening in the rectovesical fascia, above and behind the broad ligament, and the opening in the levator below and in front of the broad ligament, were so far removed (about 2 inches) from each other, that it would be impossible, without extensive dissection in a very vascular area, and complete mobilization of uterus and right broad ligament, to close the muscular hiatus as well as the fascial opening from above. In other words, we realized that we were dealing with a combined (anterior and posterior) variety of hernia and a combined operation would be necessary. We realized further that even if we were to close both of these openings from above, the opening in the pelvic (ischiorectal) fascia below would remain and the sac although cut off would remain. The fact that we were dealing with pregnancy and its accompanying vascularity was further argument against [illegible] sive dissection. Therefore, we decided to content ourselves simply with closure of the ring, leaving the rest to be completed at the second stage through the vaginal route. The bowel was drawn out of the sac and held taut and the peritoneal margins of the ring were completely circumsized. This exposed to view the raw edges of the rectovesical fascia. This [illegible] opening was then closed with eight interrupted sutures of fine Pagenstecher thread. Above this a second layer was placed using six double [illegible] Pagenstecher interrupted sutures for closure of the peritoneal edges covering over the first layer. To form an additional barrier the broad ligament, at the lower edge of its base, was brought over against the sacro-uterine ligament, thus joining the two arms of the triangle with five interrupted Pagenstecher sutures obliterating the fossa. Just mesially to this last line of sutures the rectosigmoidal junction was attached to this column by a single Pagenstecher stitch to prevent knuckling of the bowel at this point. The pelvic loop of the sigmoid was then drawn out of the pelvis and fixed by four sutures to the anterior surface of the psoas muscle and the peritoneum covering this muscle with four sutures of Pagenstecher thread (sigmoidopexy). Sterilization was then performed by removal of both tubes well into the cornua in the usual manner and closing the cornua with Pagenstecher thread. The abdomen was then closed in the usual manner—using three stay

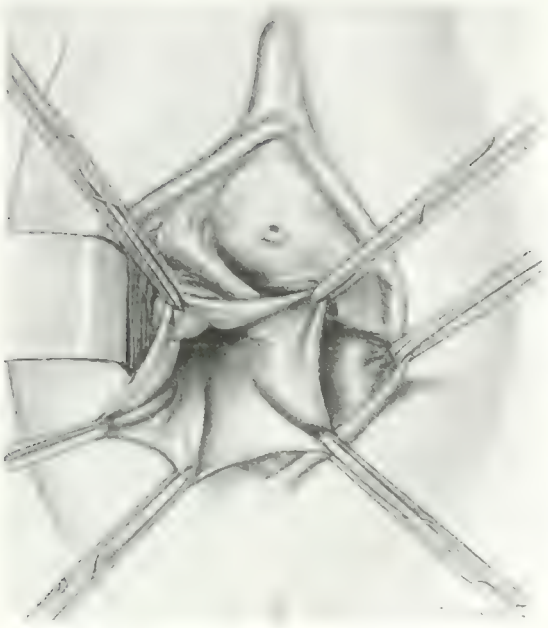


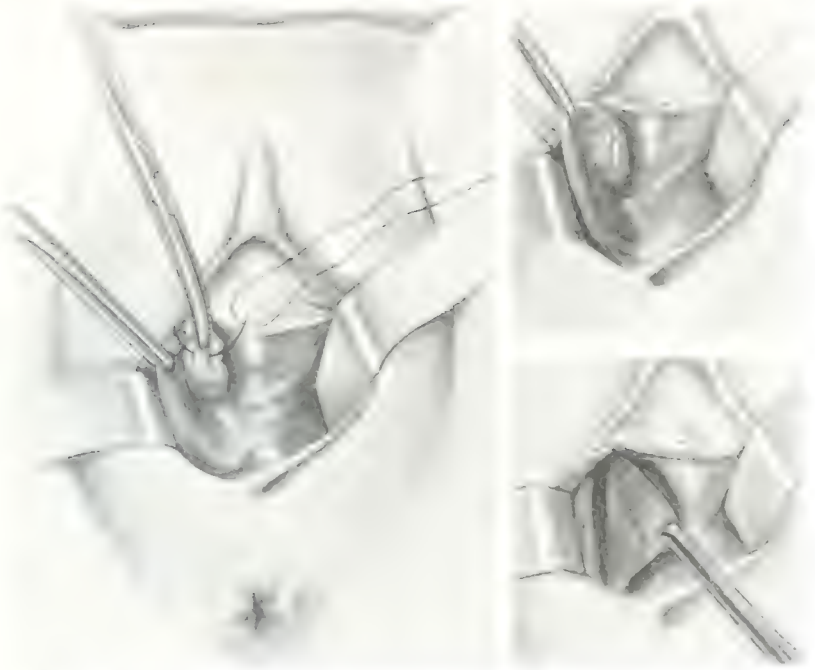
Fig. 13. Vaginal route. Empty sac split and held open. Finger passed into sac could easily feel internal closure of fascia—see abdominal route. Figs. 7 and 8.

Fig. 14. Vaginal route. Transfixion and ligation of sac before excision. The sac was actually ligated at a higher level than represented here.

sutures of silk (B. & B.) and black silk for the skin. Convalescence was uneventful and afebrile. The abdominal incision healed by primary union. Her general condition remained good. On the twenty-third day, the patient not having been out of bed the second stage of the operation was undertaken as follows:

Stage 2, plastic repair. A curvilinear incision 3½ inches long was made beginning at the mucocutaneous junction high up within the right labial fold opposite the opening of the duct of Bartholin's gland, extending downward and across the perineum at the mucocutaneous junction to the same point on the opposite side. The mucous membrane, superficial fascia, and skin were dissected up, including the anterior layer of the triangular ligament, thus exposing the triangle (subpubic triangle) bounded internally by the constrictor cunni, externally by the ischiocavernosus muscle, and below by the right transversus perinei muscle. The hernial sac was seen to bulge through this triangle and through an opening in the split levator and ischiorectal fascia which would admit three fingers. The sac was pear-shaped, now being empty, and about the size of a large pear. The right levator had been split by the protruding mass so that a band about 1 inch wide of levator fibers was internal to the sac and the remainder of the levator external to it. The inner band of levator fibers was separated from the sac which was adherent to it and this band pushed outward. The adhesions of the sac to the split edge of the levator explained why it had been impossible to invert the sac into the abdomen during the abdominal operation. The sac was then freed up to its neck and split open. The sac was empty, lined with peritoneum on its internal surface, and a finger passed into the sac up to its neck felt the sutures firmly uniting the pelvic fascia above (these sutures having been placed during the abdominal operation). The split sac was transfixed at its neck with a suture of kangaroo tendon tied off and excised high. The stump was then carried outward to the right and behind the broadest portion of the right levator muscle and the sutures transfixing this were brought through the levator and sutured through and through also catching the reflexion of the fascia at the white line, thus fixing the neck of the sac against the posterior surface of the broad base of the levator. The torn levator was then repaired by suturing the two bundles together with three interrupted sutures of kangaroo tendon. The opposite levator was then dissected out and an ordinary levator myorrhaphy performed using five kangaroo sutures, suturing the muscle together in the median line. The torn and attenuated ischiorectal fascia was then repaired by suturing with interrupted stitches of fine kangaroo tendon. The mucous membrane was then closed in the usual manner with interrupted stitches of fine chromic gut, with excision of the redundant mucosa and a subcutaneous stitch closing the skin.

Following the second stage of the operation patient made a speedy and uneventful convalescence.



myorrhaphy and perineorrhaphy was performed.

She was allowed out of bed on the eighteenth day and discharged from the hospital on February 2, [illegible] as follows: Abdominal incision—primary union. Vaginal incision and perineorrhaphy—solid primary union. No protrusion or bulging—relieved of all symptoms.

The patient has returned [illegible] from all symptoms up to the present time, although through necessity she has worked hard. During [illegible] year she has had six [illegible] self and other members of the [illegible] failed to show any [illegible] postoperative treatment has been a nightly [illegible] liquid petrolatum. The last follow-up examination, November [illegible] cision well healed and solid. Vaginal incision well healed and solid. No bulging or protrusion on coughing or straining; no sign of recurrence. Uterus in normal position [illegible] Dr. Ward, Dr. Farrar, and Dr. Ch[illegible]

SURGICAL ANATOMY

So many intricate and interesting problems are presented in the mechanism and anatomy of this type of hernia that it would seem appropriate to describe more fully here the surgical anatomy of this condition.

1. *Point of entrance (or internal ring).* This may be anterior or posterior to the broad ligament, giving rise to three varieties: first, [illegible] anterior or direct; second, posterior or indirect; or third, a sac originating behind the broad ligament may push forward under the broad ligament and break through the levator anteriorly, thus combining features and contents of both anterior and posterior types. To [illegible] this we have given the name "sublime type."

The point of entrance of the posterior variety or its beginning is at the weak point in the pelvic diaphragm internally. From a consideration of the anatomy and formation of the various layers of the pelvic diaphragm and from a study of dissections and by a reference to Figure 1, it will be seen that this weak point is at the three posterior divisions of the levator muscle. It is obvious at once that the lateral portions of the levator (m. ilio-coccygeus) does not overlap the central portion (m. pubo-coccygeus) laterally, but passes onward to fuse directly with the pubo-[illegible]

leaves a space on each side behind the broad ligament where there is no muscular covering and where the pelvic or rectovesical fascia is separated only by areolar tissue from the ischiorectal fascia, the two fascial planes being in contact, obviously a weak point. No such condition exists anterior to the broad ligament where the lateral (m. ilio-coccygeus) portions entirely overlap and fuse with the pubo-coccygeal portion of this muscle. This no doubt explains the predominence of the posterior variety (8 out of 11 cases reported) and further the fact that only the traumatic varieties are anterior (direct trauma). The internal boundaries of the posterior variety (i.e. of the ring) are then, the broad ligament anteriorly, the sacro-uterine ligament mesially, and an imaginary line between two areas of the triangle. The rectum forms (irregularly) part of the mesial boundary posteriorly. The boundaries of the anterior variety at the point of entrance are the uterus and bladder mesially, the round ligament externally, and below the vagina and the transversus perinei muscles, while the base is formed by the lineæ terminæ of the pelvis. The significance of the transversus perinei muscle as a boundary for differentiation between pudendal and perineal herniæ has already been pointed out in the classification.

Sac and contents. The sac is obviously longer and more definitely defined in the posterior variety (i.e. in herniæ originating posterior to the broad ligament). This is of practical importance because the surgical principles of high ligation of the sac and closure of ring are applicable always to this variety. This I wish to emphasize because, although pudendal hernia has been regarded as a hopeless surgical problem, the posterior variety at least is always amenable to surgical repair and to the application of the two principles mentioned above. Careful examination will determine whether a given case of pudendal hernia is of the anterior, posterior, or combined variety. In the first place with the hernia reduced, the point of entrance internally may be felt and its position relative to the broad ligament and uterus decided upon. Further, the contents of the posterior variety is usually gut alone with bladder or with ovary and tube, and the "combined" can easily be recognized by the fact that it contains both bowel and bladder. It may contain ovary and tube also, but always bowel and bladder, both of which can be recognized by symptoms and examination. The anterior variety always contains bladder. The practical bearing of recognizing the contents of the sac and type of sac (anterior, posterior, or combined) will be at once apparent in the description of the operation and pictures of same. In producing the three types of this hernia artificially in the three cadaver dissections, this classification as a practical basis for surgical repair became at once apparent. The posterior and combined varieties, containing bowel, are always of the sliding type.

In the anterior variety we find a more difficult and different situation. The sac is less defined and only partial because the bladder which forms the contents of the sac, is only partially covered by peritoneum—laterally and inferiorly—so that the hernia is necessarily of the para-peritoneal variety. The sac is, therefore, incomplete and its removal and closure fraught with far greater difficulties (Case 11—Moschcowitz exemplifies this).

Canal and course. The posterior variety passes downward and forward perforating the rectovesical fascia, then the ischiorectal fascia to its ring and exit to be presently described. It may pass through the levator or through the weak fossa above described, and pass forward guided by the ischiorectal fascia. The posterior variety may also burrow forward and downward under the broad ligament, perforating only the rectovesical fascia and become anterior to the broad ligament before perforating the levator, thus constituting the combined variety (containing both bowel and bladder). In the anterior variety, the course and canal with incomplete sac is obviously much shorter, passing directly downward and forward to the ring and point of exit.

External ring or point of exit. This is an irregular triangular area bounded externally by the ascending ring of the ischium and a part of the descending ring of the pubis, mesially by the vagina, and posteriorly by the transversus perinei. It is this ring that can be

TABLE I—ETIOLOGY

Case No.	Author			Age				
1	Mery							
*2	Cruveilhe							
*3	Cooper							
*4	Cooper							
*5	Cloquet							
6	Hartmann							
7	Hasser						Ven	
*8	Koenig							None
*9	Von Winckel					Right		
*10	Von Winckel							
*11	Meisels							
12	Gerster					Left		
*1	Chase				F			

easily palpated and digitally explored in these cases. The transversus perinei muscle forms the posterior boundary of the weak triangle of exit, which is covered only by two layers of the triangular ligament (thin fascial layers). The other boundaries of this triangle, through which the hernia passes after coming through the ring (these muscles also forming part of ring borders) are the constrictor cunni internally and the m. ischiocavernosus externally.

Having traced the entrance, course, and exit of the various types, let us follow the sac reversely; that is, from without inward in the combined type as described in case here reported and note the structures through which it passes. Covering the knuckle of bowel and bladder, from without inward, we have the skin and mucosa and peritoneum only. The structures penetrated from without inward are, the anterior layer of the triangular ligament, posterior layer of the triangular ligament, ischiorectal fascia, levator and rectovesical fascia. In the direct or anterior variety the structures penetrated by the sac and the coverings of the sac are the same as in the posterior variety, except that peritoneum only partly forms the sac and the hernia is of the para-peritoneal type. A clear understanding of these anatomical relations is necessary for a successful repair of this type of hernia.

Mechanism of occurrence. The long pelvic loop of the sigmoid fixed only at its junction with the fixed rectal portion of the gut at the end of the mesentery (opposite the third sacral vertebra) "knuckles" at this fixed point after slipping down along the posterior surface of the broad ligament. At the site of this kinking (rectosigmoidal junction) is the weak spot of the pelvic diaphragm above (Fig. 1). In this angulated position the gut "slides" *en masse* forward and downward pouching the peritoneum ahead of it, tearing through fascia, levator, etc., thus forming always the "sliding" type of hernia. The kinking and partial obstruction at the rectosigmoidal junction explains the rectal symptoms and their intermittent character.

Etiology

Primarily, of course, all of the factors bearing on the etiology of all herniæ must be considered. Von Winckel in his discussion of pudendal hernia says that they are congenital or acquired. Pregnancy and parturition are the factors of most import and we find that the largest majority began during labor or were noted soon after. Difficult and instrumental cases are noted and emphasized in the majority of cases. This was true of my case. It is evident that trauma is a direct and activating factor. Age naturally would fall during the child-bearing period. The youngest is Cooper's case, 22 years old, and the oldest is 51 years, von Winckel's case. Not a single verified case is reported in the male. Von Winckel, in discussing this point, refers to a male infant, age 6 weeks, who had a protrusion through the sacrum opposite the second spinus process, the size of a walnut, which bulged and increased in size on coughing and straining and which underwent spontaneous cure as the bone developed and the opening closed. However, this case has been excluded by most authors as not a true pudendal hernia and was probably a meningocele on the basis

of spina bifida, and was so considered by Moschcowitz in his admirable paper. Von Winckel also mentions in the same article case of a male child, age 7 days, who presented along the left side of the pubis near the scrotum, a mass the size of a pigeon egg which was reducible. The description is too meagre and indefinite to be included as a proven case of pudendal hernia. (If these two cases could be verified and accepted they would be the only two cases in the male on record, and the only two spontaneous cases recorded

DIAGNOSIS AND DIFFERENTIAL DIAGNOSIS

Pudendal hernia should offer no great difficulty in diagnosis. There are certain essential features which make it certain of recognition. The most important are: First, the hernia always appears in the posterior part of the labium majus. It cannot appear elsewhere and also come through the subpubic triangle. Second, the mesial half of the protrusion is covered with mucous membrane and the other half with integument. Third, associated with these two features are all the ordinary signs of hernia: impulse on coughing, reducibility, etc. A consideration of the three points mentioned above will easily differentiate pudendal from the other forms of herniæ—inguinal, femoral, etc. and from bartholinian abscess. Rectocele or cystocele can never be confounded with this type of hernia.

TREATMENT

In spite of the fact that only one pudendal hernia has been reported cured (my case here reported being too recent to speak of as cured), we feel that a better understanding of the anatomy of this condition and the classification into three types, as a practical basis for operation, will lead to a more hopeful outlook. A consideration of the anatomy as exemplified in cadaver dissection and in the pictures herewith presented will, we believe, bear this out.

The anatomy is easily understood and the principles necessary to the successful cure of all herniæ are here applicable; namely, high ligation and excision of the sac and closure of the ring. This is particularly true of the posterior and combined types in which there is a definite sac. The anterior variety, with greater destruction of the levator and fascia, especially where large areas of these structures are ruthlessly torn away by forceps operation, the problem presents infinitely greater difficulties. Even here, where ligation and removal of the sac is impossible, and the problem resolves itself into closure of the ring, an exact understanding of the anatomy and a repair based on a knowledge of the structures involved, is necessary. In these extreme cases we would suggest a transplantation of the iliac fascia with pedicled flap held between the transplanted pedicled round ligaments for closing the defect above, together with a pedicled fascial transplant of fascia lata to plug the subpubic triangle below.

CONCLUSIONS

While it is obvious that no conclusions can be drawn from one case, nevertheless from a study of the 13 cases reported, the anatomy as shown in my case and in cadaver dissections studied, we feel that we are justified in making the following deductions:

1. Pudendal hernia, although extremely rare, should be easily recognized (three points).
2. All cases should be divided into anterior, posterior, or combined types as the basis of operation.
3. Every case should be submitted to operation.
4. A knowledge of the anatomy, the type presented and application of the principles of the operative treatment of all herniæ should result in a cure in a large majority of cases.

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NATURE AND SIGNIFICANCE OF RENAL STASIS

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MY interest in renal stasis aside from the operative treatment of hydronephrosis has been incited through the study of persistent colon bacillus infections. Preliminary report on this work has already been published (Crabtree and Sheddon, 1). In the course of these investigations I came to recognize that small degrees of stasis in the kidney existed, often associated with pain and very commonly associated with persistent infections. Further observations on pyelitis in pregnancy and stasis from renal abnormalities, together with investigations of cases of abdominal pain encountered in the Out Patient Department of the Massachusetts General Hospital and my own office work have convinced me that considerations of renal stasis from the physiological rather than the pathological point of view might add knowledge which would have bearing on the treatment of these conditions. I mean by that, determination whether the kidney is hampered in elimination of urine from the pelvis rather than whether a dilatation sufficient to term hydronephrosis exists.

Heretofore classifications and, so far as I am able to determine from the literature, treatment also has been based on the pathological picture presented first of all by autopsy and surgical specimen, later by the pyelogram. Attempts have been made by the urologist and the roentgenologist to determine from the appearance of the pyelogram almost entirely to the exclusion of data which is obtainable by use of the cystoscope and ureteral catheter as to whether or not a kidney is pathological. This I believe to be erroneous. As a result of this conception beginning dilatations and small degrees of change are often overlooked at a time when remedia measures could best be applied. Likewise because of incomplete knowledge of greater degrees of dilatation which are temporary in nature, unnecessary destructive operations have been done. A recent classification of hydronephrosis bears evidence to this contention. In fact this classification seems to me to be based entirely on size of the pelvis as shown by pyelogram. By it hydronephroses are divided into

1. Early hydronephrosis;
2. Moderate hydronephrosis;
3. Large hydronephrosis.

To be sure the relation between infection, mechanical obstruction and disturbance of innervation are discussed. Such a classification however, misses many of the important points on which therapeusis must depend. These classifications are analogous to classifying into large bears, bears and little bears. Any hunter will recognize that it is more fun to shoot the big bear. Consequently large hydronephroses have received more consideration at the hands of the surgeon and occupy a larger place in the literature of the subject. Yet these must have had beginnings and be results of factors which have been operating a long time past to produce the condition encountered.

I believe that four types of renal stasis ought to be recognized to exist between the normal kidney and the large hydronephrosis. These are

1. Acute stasis;
2. Subacute stasis;
3. Intermittent stasis;
4. That condition known for want of better names as relative stasis, atonic dilatation (Braasch), idiopathic dilatation (Bard), and potential obstruction (Robinson); terms applied to the occasional case of reno-ureteral dilatation without obvious cause. It will be recognized that the above classification is based on the physiology of elimination of urine from the kidney rather than the degree of pathology produced.

DEFINITION OF TERMS

In order to indicate what is meant in this discussion by the terms "pelvic content" and "pelvic capacity" in the observations recorded, I will define the two.

Pelvic content is the amount of urine present in the pelvis at the time a plugged catheter is inserted into the pelvis. After inserting the catheter the plug is removed and a syringe attached. With the bladder empty to provide against suction of fluid up the ureter from the bladder, if such reflux is ever possible, all the urine that will flow freely and steadily into the syringe is withdrawn and measured. This is taken to indicate the pelvic content.

Pelvic capacity is measured by the amount of fluid which can be injected into the pelvis sufficient to produce pain *and withdrawn*. The amount withdrawn and not the amount injected represents the capacity.

THE NORMAL KIDNEY

Clinical observation substantiated by animal research has given us some definite facts regarding the secretion of urine. Variations in the renal pelvis make it impossible to state a figure which accurately represents a normal capacity for the renal pelvis. Pelvic capacity seems susceptible of wide interpretation. Fenwick considered 2 ounces the upper limit of normal capacity, Kelly and others, 3 drams. Seres finds the average pelvic capacity in the normal to be 6 to 7 cubic centimeters, average postmortem distensibility 15 cubic centimeters. This is a fair estimate of the average established by most clinical workers. I have found that it is seldom that a normal pelvis can be distended to more than 10 cubic centimeters, and use that as a working basis. The great majority of normal pelves will not allow that degree of distention. It must not be forgotten that in certain instances in which there is congenital inequality of distribution of kidney tissue the congenitally large normal kidney may have a pelvic capacity in excess of 10 cubic centimeters, and yet be free from any evidence of abnormalities in outline. Even though the average capacity of the pelvis is in the neighborhood of 6 to 7 cubic centimeters, during excretion, it is not full to capacity. Seldom does one find more than 2 to 3 cubic centimeters of urine in the pelvis of the normal secreting kidney. Peristaltic muscular movements beginning in the pelvis but more pronounced in the funnel portion near the pelvo-ureteral junction force small amounts of urine into the ureter. Successions of peristaltic waves carry these small quantities of urine down the ureter, from which they are ejected into the bladder in small jets. Fluoroscopic demonstration, while not entirely satisfactory, has given some evidence on this subject, but series of plates taken at short intervals after injecting the pelvis with opaque solution have made this muscular movement evident. A pelvis completely filled with thorium or sodium bromide solution will empty itself completely in from 6 to 7 minutes. Overdistention of the pelvis to the point of producing pain is associated with or followed by increased peristalsis of the pelvis and the ureter. It is also recognized by urologists that in the larger hydronephrotic pelves overdistention is either painless or produces only a dull ache and is not accompanied by cramp-like pains as in the normal kidney. Seldom are peristalses seen in these pelves. The degree of relaxation and fibrosis of the pelvis and loss of contractility is, of course, the reason for this phenomenon.

For the sake of clearness in the consideration of stasis, I wish to adopt the point of view taken by Gardner (F. E. Gardner, 2) and exclude the large renal dilatations in which destruction of the kidney has already taken place. These complicate the picture because they are end-results in which the etiological factor has already done its work and is often not easily recognizable. "Let us put aside all cases in which the urinary distention though localized to the upper urinary tract is only an epi-phenomenon in the evolution of an altogether different disease." This, of course, excludes hydronephrosis due to pelvic tumors such as carcinoma of the uterus, prostate, vagina, and rectum; fibroid growths, procidentia, ovarian cysts; tuberculosis, adenitis and bladder and urethral obstructions. I also wish to exclude those large end-result renal dilatations in which it is difficult to state the factors which have operated to produce the dilatation and renal destruction. It is usually impossible from the history or pathology

to unravel the factors which have operated to produce these conditions. They are conditions already beyond hope of remedy. "Any large easily felt hydronephrosis is the evidence of failure; any large easily felt pyonephrosis is the evidence of culpable neglect—both might have been avoided" (E. H. Fenwick, 3). After this limitation of the subject I shall now proceed to discuss the four classes of stasis previously mentioned as existing between the normal kidney and the large hydronephrosis.

ACUTE STASIS

Acute stasis is, I believe, almost entirely emergency. It occurs most commonly with stone but is seen in accidental ligation of ureters, plugging of the ureter and pelvis by blood clot, and some degree of acute stasis has been shown to exist during acute attacks of pyelonephrosis, due to swelling of the ureteral mucosa, particularly at the uretero pelvic junction. I have found some degree of stasis in most cases in which cystoscopy was done during the acute stage of colon bacillus pyelonephritis. In most instances the cause of acute stasis is easily and early removed. Older experimental work by Cohnheim and Alberran showed that obstructing the ureter produces sudden rise in pelvic pressure in the kidney which often reaches 73 millimeters in an hour. Sudden complete obstruction, however, paralyzes the secreting power of the kidney which is reasonably soon destroyed before time has elapsed sufficient to allow dilatation of the pelvis. When these kidneys are cut down upon, a small tense pelvis is found with almost stony hardness of the kidney and a tense dilated ureter of somewhere between twice and three times the normal size extending down to the point of obstruction. When pyelotomy is done, even though 4 or 5 days have elapsed since the obstruction intervened, there is a violent gush of urine and almost immediately the kidney takes up its function of secreting. The polyuria which follows relief of obstruction immediately sets in, continues for 24 to 48 hours, after which the urine becomes more concentrated and the flow more nearly normal. I have not seen acute complete obstruction for a period exceeding 4½ days, but have frequently seen cases from [illegible] days after complete obstruction. These latter cases were due to stone, in all except one instance in which, following an injury, the kidney and ureter became plugged with blood clot, completely stopping secretion. This was of 3 days' duration. In one instance I have seen both ureters tied into the stump of the uterus at hysterectomy and completely obstructed so that no urine whatever was passed for 4½ days. I did bilateral pyelotomy, later dilating the ureters through the bladder after the ligatures had softened. In this instance both pelves returned to normal capacity. The same was true of the case of hæmorrhage into the pelvis and ureter after I did pyelotomy for drainage. In the cases of stone the pelves were all small, yet it is impossible to state in stone cases whether dilatation may not have been produced by the presence of the stone in the pelvis before the acute obstruction took place. Bradford found in animal experimentation that after complete obstruction of the ureter the kidney would return to its normal form if obstruction was removed after from 10 to 40 days. It is my belief that acute obstruction even though complete, when encountered clinically, is not serious in its after effects and we may expect the kidney to return entirely to its normal condition when the obstruction is removed.

SUBACUTE STASIS

By subacute stasis I refer to those cases of partial obstruction with back pressure and overdilatation of the kidney, which is of weeks' or months' duration. The outstanding class of cases in this group is the back pressure kidney associated with pregnancy. Since Rayer in 1841 remarked the difference between ordinary pyelitis and the pyelitis of pregnancy, it has been recognized that there is hydronephrosis developed with or without pyelonephritis symptoms during the period of gestation. Stasis of this type I have frequently found in the absence of pyelitis, although usually not to so marked a degree as in the presence of infection. This subacute type of obstruction is, however, easiest

studied in pregnant women because of the known duration of the obstruction, which of necessity cannot exceed 9 months, and the complete removal of the obstruction suddenly at the termination of pregnancy. It is not uncommon to find pelvic dilatation of from 30 to 480 cubic centimeters in this type of case, often in patients whose symptoms have persisted only during the last months of pregnancy. Caulk calls attention to the readiness with which some of these cases are improved by cystoscopic treatment (Caulk, 4). However, he has produced no evidence to show what was the end-result to the kidney at the termination of pregnancy.

Braasch in discussion denied the existence of large hydronephroses occurring during pregnancy. This last statement I believe to be erroneous because my experience with these cases (which will be published later) has shown the frequent occurrence of dilatation ranging from 30 to 480 cubic centimeters. They are usually in excess of 200 cubic centimeters. In this connection it is important to recall Perinæus' three grades of renal retention. These are dependent on the amount of distention and the damage to the elastic tissue in the walls of the pelvis and ureter.

1. Retention of small quantities of urine. This urine is under pressure from the elasticity of the pelvic wall, the tissue of the pelvic walls are under tension but have not lost their tone.

2. More pronounced dilatation, fibrous tissue is weakened but has not completely lost its tone.

3. The kidney is damaged, fibers are overstretched and incapable of returning to their normal. The renal function in these kidneys is greatly impaired.

This classification, of course, does not apply except in part to the subacute stasis under discussion. It does not apply because even though the overdilatation of the pelvis is extreme it has not existed long enough to produce flattening and thinning of the cortex but approximates a purely pelvic change. It does apply, however, in that the retention of small quantities of urine seems not quickly to influence the pelvis and that greater dilatation is possible without complete loss of the elasticity of the pelvis, and third, that in overdilatation some degree of permanent pelvic damage seems to be constant. I have evidence to show that in these pregnant women in whom stases of 200 to 300 cubic centimeters has decreased to 15 cubic centimeters at the termination of pregnancy, instead of remaining at the latter degree of dilatation, the pelvis may simply by the process of the disease, undergo further dilatation in succeeding years without the intervention of subsequent pregnancies. In other words, small degrees of permanent damage in the presence of infection may progress toward pyonephrosis.

Mrs. F. R. M., Jr., 2 pregnancies, first 4 years ago, second 1 year ago. During the first pregnancy patient had pruritis for several months from urinary incontinence. During puerperium she had fever and pyuria. During and after the second pregnancy she had incontinence for 3 months and some slight degree of bladder irritability. The incontinence was worse on walking, coughing, or sneezing. Catheter urine examined once since birth of last baby 7 months after delivery and found to contain much pus.

At certain times, particularly when tired, she has much frequency and some burning micturition. She is comfortable only when taking hexal, which she has taken most of the time for 4 years.

The right kidney is low, descending to the crest of the ilium. The left kidney cannot be felt. These observations are corroborated by X-ray.

Cystoscopy showed slight redness of the bladder mucosa. This was not marked. There was a dull œdematous-looking trigone.

Both urines were cloudy and contained a small amount of clumped pus and a few bacilli which in culture proved to be bacillus coli. Functional test (phthalein) showed a decreased output from the right. Right kidney 10 per cent, left 20 per cent. Both pelves were found under 12 cubic centimeter capacity.

This examination was made in October, 1920. The patient remained entirely comfortable on 20 grains of hexal a day until January 5, 1921, when she began to have increased discomfort and more marked pyuria. These symptoms have continued since.

Pyelograms taken in November, 1920, show "The shadows of the injected pelves normal in size and shape; the calyces small and somewhat irregular but the cupping is present."

Cystoscopy, March 24, 1921, showed no particular change from the findings of October of the preceding year, except that repeated estimations of the pelvic capacity (made with the bladder empty),

showed the renal pelves to have increased in capacity; the right to 20 cubic centimeters, and the left to 25 cubic centimeters.

It is to be noted that the right kidney shows ptosis, the left none, yet the left is the greater dilatation. There is no other apparent reason for the change in the size of the infected pelves than the pyelitis and the occurrence of attacks of pyelonephritis which occasionally intervene. Yet appreciable damage to the kidneys has taken place in a reasonably short space of time.

Another type of subacute obstruction, perhaps equally frequent if not more so than the pyelitis of pregnancy, is the slowly progressing and partially obstructing ureteral stone. In those instances in which I have been able to pass a catheter by a stone which was known to have been present in the ureter for several months, I have been able to determine ureteral and pelvic dilatation which exceeded by several times the capacity of that same kidney after the stone had been removed. Even small stones which are not sufficiently large completely to obstruct the ureter and are known to be rapidly passing down, the passage of a catheter into the pelvis of the kidney shows a fair degree of stasis even in the intervals between attacks. Undoubtedly, obstruction here is not complete, yet the swelling of the mucosa of the ureter together with the stone definitely embarrasses the drainage on that side. Where this condition exists for many months, permanent damage may result. The problem for the urologist is to determine, if it is possible to determine that fact, something of the time element required in these cases to produce permanent damage, and to see that these stones are removed within a safe interval. I suspect that time sufficient to produce damage in one kidney may fail to produce it in another. No doubt also subacute stasis in the kidney is frequently encountered in those cases of prostatic obstruction which are of rather sudden onset and of relatively short duration. However, the point which I wish to emphasize is that by recognizing subacute stasis as an entity, the kidney may, by early intervention, be spared even small degrees of damage. I wish to present the data of a case of acute of pregnancy to which some idea of the date and degree of return to normal has been determined.

[illegible] urinary tract at any time preceding this, her first [illegible] could be palpated as a large soft mass, even though its outlines were obscured to some extent by 7 [illegible] tion made immediately before the first [illegible] infected urine. Following miscarriage the temperature [illegible] The urine continued pale but contained considerable pus. At the end of 6 days, patient [illegible] cystoscoped on account of rising temperature [illegible] yellow pus withdrawn. Under ordinary circumstances the condition would [illegible] considered a pyonephrosis suitable for nephrectomy. After emptying the pelvis the pelvis was [illegible] cloudy urine. When dilated with boric solution [illegible] represent the capacity of the left kidney, which 6 days before had been dilated to 280 cubic centimeters. Patient was cystoscoped again 6 days later (that is, 12 days after delivery). Both urines were cloudy, the right pelvic capacity was 26 cubic centimeters, the left 16 cubic centimeters. [illegible] from the date of delivery), the right pelvis showing [illegible] centimeters. Patient reported by letter March 17, [illegible] kidneys were giving no pain.

Similar cases, yet not quite so striking since pyonephrosis did not develop after delivery, have shown that the pelvis returned to somewhere near normal capacity only to have repeated attacks of pyelonephritis develop and subsequent cystoscopic examination demonstrate gradually increasing pelvic capacities. Whether this increase is due to relaxation of the pelvic walls by infection or whether the dilatation is the result of a

creased residual during the attacks of pyelonephritis cannot be determined. That these pelves are capable of progressing toward pyonephrosis seems to me to be definitely indicated. Subsequent investigation of this group of cases will determine that fact. The recognition of this and similar sequences of events are significant in the handling of the patients with pyelitis of pregnancy. The bearing of these observations on other types of subacute stasis is apparent.

INTERMITTENT STASIS

Intermittent stasis is in part the question of the floating kidney. Keen considers the movable kidney next to pelvic tumor the chief cause of renal dilatation. The literature of ptosis and particularly of renal ptosis is voluminous. It is chiefly the literature of the past decade which saw the development of fixation and the change in sentiment against the indiscriminate fixation of movable kidneys. The development of the pyelogram which makes possible detail study of this group of cases, now allows us to review from a new standpoint much valuable literature on the subject.

There are other conditions besides renal mobility which may give rise to temporary renal obstruction of an intermittent nature. Supernumerary vessels should, I believe, be classed as one of these. Renal mobility is probably intimately associated with aberrant arteries in all cases in which pelvic stasis results. For this reason the two conditions must be considered together.

The frequency with which renal mobility is encountered both as regards age and sex is fairly well established. Kuester, in a survey of normal individuals, found renal mobility in 1 to 207 men, 1 in 22 women. Hahn, in 100 women, found renal mobility in 5.5 per cent. In 50 children, including equal numbers of males and females, he found but 1 movable kidney. He found the right kidney movable 15 times as frequently as the left. Landeau found both kidneys involved in 5 per cent of all cases in which there was renal mobility. Skorchewski found floating kidneys in 2.2 per cent of all individuals examined. Lancereaux found floating kidney in a proportion of 55 women to 5 men and four times as often on the right side as on the left.

"By and large, nephroptosis is encountered clinically in three classes of cases: (1) without symptoms, (2) without symptoms directly referable to the kidney, (3) with symptoms referable to the kidney" (Keyes). Keyes' statement is distinctly a statement of the facts, particularly if we conceive the first group to be disproportionally large. In other words the great majority of palpable kidneys are functioning normally in spite of some degree of mobility; yet the preponderance of pyonephrosis, hydronephrosis, persistent pyelitis and renal pain in the right side as compared with the left, in the female as compared with the male, and in the adult as compared with the child, points to some degree of significance in these anatomical differences. It also indicated that renal damage is a progressive condition, i.e. has small beginnings.

The time-honored classification of movable kidneys into congenital and acquired mobility must be remembered. It is probable that we must revise our view regarding the numbers in the first group. Morris' statement that "a floating kidney with a mesonephron is, of course, always congenital" is a fact. Such cases are rare. Their very existence has been denied by Alberran. Gardner has pointed out that congenital defects in the development of the ureter may play a rôle in these low movable kidneys in the production of stasis (Gardner, 5). He adopts Pasteau's classification of renal mobility, which is:

1. True ectopic kidney in which the renal vessels take origin low down on the aorta or from the common iliac.

2. The origin of the vessels is slightly below the normal position, the kidney pedicle is long, the kidney can be replaced into its fossa.

3. The origin of the vessels is normal, but the pedicle is long, the kidney is freely movable but remains vertical.

4. The origin of the vessels is normal, the pedicle is short, the kidney on descending assumes an oblique position. This last is the typical acquired mobility.

Certain congenital ureteral conditions may

play an important part in the development of stasis not only in the normal kidney but particularly in the movable kidney. These congenital factors are: (1) developmental rotation of the kidney, (2) fœtal valvules. These factors are more common in the upper segment of the ureter but are also occasionally found near the bladder. Wolffer in 100 newborns found more less transverse folds in the mucosa near the pelvo-ureteral junction. In ten instances the outlet of the pelvis into the ureter was very much narrowed, scarcely admitting a filiform. In the fœtus these are constant findings (English). Not only are there spiral folds in the mucous membrane of the upper portions of the ureter but also striations on the outer coatings which are in evidence of the rotation of the kidney during development. After birth these normally disappear due to the eccentric pressure of the urine and growth of the ureter. They disappear from the lower segments upward, and are most apt to persist in the upper ureter near the pelvo-ureteral junction. Arrest of development may mean the persistence of these abnormalities into adult life. In the normal kidney they may be insufficient to cause stasis, but in movable kidneys they are operative.

It must also be remembered that the ureter is loosely adherent to the peritoneum throughout the greater portion of its course from the brim of the pelvis upward toward the kidney. About 3 centimeters from the pelvis the ureter leaves its close relation to the peritoneum and passes through the perinephric fat to join the pelvis. This is known as the mobile portion of the ureter. Not only is it the point at which fœtal abnormalities are most apt to exist but it is the point at which kinking of the ureter in movable kidneys is apt to take place. Kinking implies fixation of the ureter at the point of kinking. Kinking without ureteral abnormalities may and clinically seems to be unattended by evidence of stasis in many instances. In still other instances unusual thickness of the bands of fibrous tissue which normally bind the ureter loosely to the peritoneum at this point have been found to be sufficient cause for hooking up the ureter in this movable portion of its course. Frequently anomalies in caliber are found in the course of the ureter. I have usually found that the caliber of the ureter was not decreased and the apparent narrowness was merely angulation. Angulation of the ureter in this area has been much more frequently due to fibrous bands than to any other cause.

Supernumerary vessels are encountered in some instances without the appendix having produced any obstruction to the outflow of pelvic urine. Bevan in 1903 observed the first case of obstruction from aberrant vessels. English states that a vessel in front of the ureter cannot cause hydronephrosis. Kuester, Israel, Bazy, Duval, and Gregoire concur. They even reject the role of vessels in producing renal retention. Roberts, Morris and Decressac take the other extreme and contend that all hydronephroses which develop in kidneys showing abnormal blood distribution are due to vessel defects. Fenwick claims that 16 per cent of primary pelvic dilatation is due to aberrant vessels. The facts of the matter seem to be that about one out of four aberrant vessels passes behind the ureter and that a vessel in front of the ureter is not able to produce obstruction in a movable kidney. Veins seem to be incompetent to obstruct the ureter. The frequency of occurrence and the nature of arterial subdivision is well demonstrated by Eisendrath [6].

Since Landeau's papers and the work of Terrier and Baudouin it is generally believed that movable kidneys cause a type of hydronephrosis or stasis called intermittent. As a rule the movable kidney with well-marked symptoms of intermittency is not associated with large pelvic dilatation. The reason for this seems to me apparent; first of all because the stasis is not persistent throughout the 24 hours period. Stasis is produced when the patient is in the upright position and relieved in the recumbent position. It has been estimated by animal experimentation that considerable permanency to the obstruction must be provided before rapid or extensive dilatation takes place. This, however, does not militate against these kidneys being painful, representing actual temporary stasis

and showing progressive, even if extremely slow, dilatation. I have been able to demonstrate in one instance a change in pelvic capacity from 7 cubic centimeters to 14 cubic centimeters within a year's time. During this time symptoms had been present and pyelogram showed definitely the difference in size of the pelvis at the two examinations.

I have also remarked that frequent cystoscopic examinations of the same patient will show evidences of considerable overdistention of the pelvis at the time of renal distress. In one individual the capacity of the right pelvis on two examinations was not in excess of 7 cubic centimeters. On two other occasions when the patient came to my office late in the afternoon after a day of activity in shopping, the same pelvis was found to contain 15 cubic centimeters of fluid at the time a plugged catheter was inserted into it. After this quantity of urine had been aspirated off through a syringe, distention of the pelvis to 7 cubic centimeters again produced pain. It was not possible to distend the pelvis to 15 cubic centimeters. In this instance definite overdistention of the pelvis on two occasions when symptoms were present was established. Symptoms of intermittency (Dietl's crisis) was the chief complaint. The parallelism between urinary intermittency and renal mobility is not the less real because of certain discrepancies. It is not uncommon to find a patient who although she has frequently passed urine during an attack of renal pain, passes from 1 to 2 quarts of urine in the succeeding 2 hours after the pain ceases. A close parallelism would demand that this patient have an extremely large hydronephrosis which suddenly empties itself with relief of the pain. Such is not the case. Patients with marked symptoms of intermittency have usually had small pelves.

A large hydronephrosis with overdistended walls has lost its muscular elasticity to such an extent that it is unable to empty itself even when the obstruction is removed. This is apparent to those surgeons who have attempted to cure large hydronephroses by reimplanting the ureter or doing plastic operations on the pelvo-ureteral outlet. Such kidneys do not return to normal size. In most instances where symptoms of intermittency occur, pyelogram will demonstrate that the kidney which has given pain and where a polyuria follows cessation of the attack, is not greatly, if at all, dilated. I have recently had a patient whom I observed during a typical "Dietl's crisis" of an hour's duration accompanied by frequent attempts at urination during the attack. Cessation of pain was followed by polyuria. The patient passed about 2 quarts of urine in the succeeding 2 hours. Pyelogram showed a slightly bulging kidney with a kinked ureter. Cystoscopic determination of the pelvic capacity showed that the dilatation was not in excess of 10 cubic centimeters. This was a left-sided, congenitally movable kidney. "Dietl's crises" are more apt to occur in the small not overdistended pelvis in which the tone of the musculature and pelvic contractility is not lost. Such kidneys are still sensitive to distention. A parallelism is that of the painful, spreading inguinal ring during the development of a hernia. After the dilatation of the ring has been accomplished, the pain becomes less severe if it does not cease altogether. On the basis of the above argument I have done suspensions of the kidney and plastic operation for the relief of renal pain and for the cure of persistent pyelitis where small degrees of stasis existed. The operations have given uniformly satisfactory results. I believe these small degrees of renal stasis in which a small pelvis is distended to *its* capacity, are just as definite instances of renal stasis as where a large hydronephrotic sac is distended to its capacity. I recognize that suspension operations are in disfavor and to a great extent in merited disfavor. I believe it to be unsound surgery to do operative interference on a kidney either because its position is low or because the course of its ureter is not straight. I believe it to be *absolutely essential* to demonstrate the existence of stasis by means of the cystoscope and the ureteral catheter. This can only be done after cystoscopic study with several observations. I recognize that the rate of change in these early obstructions is slow because

of the intermittency of that obstruction. I plan to report on these cases only after sufficient time has elapsed to allow of determination of the permanency of results. The oldest of my cases are of but 3 years' duration. All have been relieved. Even though the relief may not be permanent, which I doubt, the operation has been justified. The maintaining of a comfortable, properly functioning kidney for that length of time is worth the price. Blind standard operations have no place in the treatment of these kidneys. Suspensions must be done with a view to remedying the defect present in that particular kidney as shown by pyelogram.

I have some evidence to show on cases which have been observed over a period of years that slow dilatation takes place. The longest one of these instances has been that of a man with bilateral small renal stasis seen in the hospital in 1913 and followed until the present time. His pelvic capacity on both sides has increased three times what it was at the first observation in a period of 9 years.

The part which ureteritis and peri-ureteritis play in producing small degrees of temporary partial obstruction must be recognized, but as yet sufficient data have not been accumulated to allow definite statements as to the importance of this condition.

It should also be mentioned that there are those who believe that the bouts of passing urine in large quantity such as takes place in intermittency have in themselves the effect of producing increased pelvic capacity (Fenwick). The thinned ureters, pelves and bladders and increased capacity of these organs in diabetes insipidus is cited.

My purpose in calling attention in such detail to intermittent stasis is that I believe it to be a large group of cases the nature of which is in great measure misunderstood and that the end-results both as regards persistent infection and pelvic dilatation are not well known. This error is chiefly due to failure to recognize the slow rate at which change takes place and the rare circumstance that allows one observer to follow a case from its inception to the final outcome, either in destruction of the kidney [illegible] attacks of pain are not severe enough, nor is the succeeding polyuria sufficient in quantity to attract attention. Yet careful observation has led me to believe that the painful kidney is a "Dietl's crisis" in miniature and the same factors operate even though the symptoms are moderate.

Fenwick has called attention to the fact that serious degrees of pelvic dilatation may take place in the absence of any symptoms in the patient's history which can be interpreted as representing a stage of painful dilatation. He believes that these kidneys are of decreased sensation. Only on this assumption can the facts of clinical experience be correlated. There is no other way in which we can explain the frequent finding of definite hydronephrotic sacs of considerable capacity either by accident or because of the presence of pyuria.

[illegible]

By this term I wish to refer to the group of cases in which there is no apparent obstruction to the outflow of urine from the renal pelvis, ureter or bladder, or if stricture exists the dilatation continues below the point of obstruction as well as exists above it. This type of pelvis and ureter are occasionally found in bilateral pyelogram on the side opposite to definite pathology. The condition has apparently existed without symptoms. In some instances the kidney is low. In other instances it is up in normal position and does not descend in such a way as to obstruct its ureter. The dilatation often continues through the bladder wall involving the sub-mucous portion of the ureter. The nature of this obstruction and the cause of it do not seem apparent. These kidneys usually function well. The cortex is often not at all thinned in such a way as to indicate any serious degree of back pressure. There are few, if any, symptoms connected with the condition if infection is absent. When infected they are extremely troublesome and do not yield readily to any kind of treatment. The ureterovesical valve is often incompetent and injection of fluid into bladder causes back-wash into kidney pelv[illegible]

The etiology of these conditions is probably congenital. In fact the ureter is often irregular and may appear as a "spiral ureter." There is often congenital absence of the sphincteric valve at the lower end of the ureter and I have once seen the condition bilateral. Pathological examination of the walls of the ureter does not show any definite pathology of a causal nature. The coats are thinned and the muscle fibers are widely separated, as is found in any overdilated ureter. In one specimen removed at operation, there were a succession of mucous membrane shelves which were responsible for the spiral appearance of the ureter as seen in pyelogram. These may have been remnants of the valvules which are described in fœtal life. Valves, however, should have produced some degree of obstruction unless accompanied by congenitally thinned ureteral walls. The kidney did not show signs of any back pressure although the pelvis was greatly dilated. It has been suggested that the condition might be due to the drag of a large cæcum or sigmoid. Such did not exist. The close relation between these cases and the cases of congenital absence of the ureteral valve seems to me to point to a similar origin.

In those instances where there is a definite obstruction of the ureter in its upper or middle portion with dilatation above the point of obstruction and pyonephrosis, infection is a sufficient explanation of the dilatation below the point of obstruction.

In placing these four groups of stasis between the normal kidney and the large hydronephrosis, I am not attempting to complicate the picture without a reason. It is that I may call attention to stasis in contrast to hydronephrosis. I believe that future study will demonstrate that it is possible to recognize the *condition* without waiting for the *result*. To treat the result is necessarily less desirable and less productive of lasting benefits to the renal tissue which overlies the pelvis. The bearing of even small degrees of stasis on persistent infections is definite evidence that this point of view which I am endeavoring to present is worthy of consideration.

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THE QUESTION OF RECURRENT RENAL CALCULI

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THERE is a disappointing scarcity of literature upon the important and interesting subject of recurrent renal calculi. In their excellent paper on this topic published in 1915, Cabot and Crabtree[2] remarked that they could "find no useful statistics bearing upon this important question." Since this date the literature contains but one article, that by Braasch, published in 1917.[3] It would, therefore, appear that the subject is unpopular either because of the long and patient labor which the accumulation of data involves, or because of the disappointing results which the investigation has revealed. Be that as it may, certain personal experiences led me to take up the question from a new point of view, and for the past year I have given it intensive study.

We are all familiar with the fact that during its residence in the kidney, a stone may give rise either to no subjective symptoms whatever, or to pain in such an unusual location that the diagnosis is not made without some delay. Furthermore, it is equally well known that in an appreciable number of patients the urine is persistently negative. For these reasons it is obvious that in order to say whether a patient has a renal calculus, he must be personally examined and have a careful roentgenographic examination of the urinary tract. The patient's statement by word or letter, and often even that of his doctor, is therefore not sufficient for the desired purposes. With this idea in mind, Cabot and Crabtree, in the article already referred to, based their conclusions only upon such cases as they were able to examine personally. There were 87 such cases, of which 63 had been operated upon for stone in the kidney, 21 for stone in the ureter. Thirty cases treated by nephrotomy showed a so-called "recurrence" of 56 per cent, while in 33 cases having a pyelotomy the figure was 51 per cent. Unfortunately, we do not know how many of these patients had had an X-ray during convalescence from or within a few weeks after operation. In the absence of this information it is impossible to say whether the stones found in a kidney a year or more after operation are actual recurrences or what may be called "left overs" from the operative procedure. My observations of the past year convince me that many of the cases would fall into the latter class.

Certain more recent investigations of my own show results which are equally unsatisfactory. Of 70 cases of nephrotomy, which includes all the operations of this type performed at the Massachusetts General Hospital from 1897 to date, the results are known in 35, either through personal communication, through the local physician, or by actual examination of the patient. Out of 16 who had a roentgenographic examination 14 showed the presence of stone in one or both sides, giving a percentage of 40 of those whose definite results were known. But here again the figures would be undoubtedly greater if all cases had been checked up by this procedure, and also many were unquestionably instances of stones left over after operation.

Of the cases of stone admitted to the genito-urinary service, 16 had been previously operated upon for renal calculus either at our hospital or elsewhere, and of this number 12, or 75 per cent, had had bilateral operations.

Furthermore, our records show that 10 patients had either passed a stone after pyelotomy or were found to have one in the kidney at the time of examination.

The situation is, therefore, serious enough to warrant careful investigation, in the belief that a more encouraging report may eventually be given. Such an investigation should not, however, be left to one man or to one clinic but rather might advantageously be undertaken simultaneously by various observers and the collected data published.

Braasch's paper in 1917, gives a more promising view of the possibilities offered by

[2] Surg., Gynec. & Obst., 1915, xxi.
[3] Surg., Gynec. & Obst., 1917, xxv, 5.

[1] Read before the [illegible]

surgery for the relief of renal calculus. Of 88 patients re-examined, including roentgenography, only 13, or 14.7 per cent, showed recurrence. Here again no statement is forthcoming as to whether a roentgenogram during convalescence or shortly after was made in these cases, but the results are sufficiently brilliant in any event.

Upon inquiry, it seems to be clear that the custom of having postoperative roentgenographic examination of the urinary tract is not by any means a routine procedure. Such an examination is now the rule in our clinic and it is hoped that the statistics will eventually be not only more valuable, but more encouraging.

Upon investigating what has already been done in this direction, I found records of only 20 postoperative roentgenograms of the urinary tract, although I am aware that more than this number have been taken but not recorded. In 9, or 45 per cent, the roentgenogram showed stone still remaining in the kidney. In the absence of these postoperative roentgenograms, which clearly demonstrate my point about the frequency of overlooking stone during operation, these stones would be recorded as "recurrences" if found at a later date.

On first thought it is strange that the removal of stones from so comparatively small a cavity as the renal pelvis should be so uncertain a matter. It is even more remarkable that nephrotomy, "an operation which fully exposes the interior of the kidney to the eye and to the finger," should yield equally unsatisfactory results. But more careful consideration will show that the renal pelvis, although small, is actually a most complex cavity, with many ramifications in the form of calices, some with tiny orifices which may readily escape detection, an observation which may hold true even when the kidney is laid widely open by nephrotomy. In many kidneys the pelvis is practically bifid, the two portions connecting with one another by a long and narrow passage, the insertion of a probe into which is often a matter rather of luck than of skill. The more one studies the interior of the kidney, whether by pyelogram or by injection of fusible metal, the more one appreciates the difficulties which sometimes must be overcome in extracting a small stone from a distant cavity. For this reason, one cannot be too careful about the pre-operative diagnostic steps. It is not sufficient to know that a stone is in the kidney; one must determine exactly which calyx it is in, the relation of this calyx to the pelvis, and the character and position of its orifice. While careful routine pyelograms may suffice, a repetition of this procedure with the patient lying on the face instead of on the back, or even on the side, may prove to be a valuable aid. Whether injection of oxygen into the perirenal tissues or into the renal pelvis will prove to be of value remains to be seen.

While not by any means attempting to offer an excuse for the fact that so many stones are left in the kidney after operation, I believe it is important to realize that the remarks just made about the peculiarities in the shape of the interior of the kidney do not end the matter. There are many other difficulties to contend with.

In the first place it is all too frequently forgotten that while the X-ray may show one fairly large shadow, this may cover other smaller shadows lying in front of or behind it. At the operation a stone corresponding in size and shape to the roentgenographic shadow and showing no facets or signs of fracture may be easily extracted. The operator, satisfied with this, may then bring the operation to a close without further ado. On the other hand, he may conscientiously search for other stones but fail to find them. The causes of failure are numerous. In the first place, the manipulation required to extract the first stone, no matter how brief or gentle, and whether instrumental or digital, often produces considerable bleeding from the pelvic mucosa. If the remaining stone or stones be small they may become surrounded with fibrin to such an extent that the usual grating sensation elicited by a metal instrument is lacking and the stone is not detected. It is a not uncommon experience to wipe out innocent looking blood clot from the wound and find within it a small calculus wrapped in a dense layer of fibrin. In the presence of

such bleeding, the removal of stones of small size may be wellnigh impossible. I have tried to overcome this difficulty by the simple process of irrigating the interior of the kidney in an attempt to dislodge both clot and stones. An old fashioned silver catheter will serve well in most cases, and boric acid solution or sterile water can be forced through this with considerable pressure by the use of a hand syringe. In certain instances I have thus removed calculi which I was unable to find in any other way; in other cases a subsequent roentgenogram showed that this method is not wholly reliable. An experience with two or three cases of small multiple calculi scattered around in various portions of the kidney has convinced me that the successful handling of such a situation will tax all of one's skill and ingenuity and will often lead one to consider the advisability of nephrotomy or even of nephrectomy. At the same time, when one is handling a normal looking kidney, the urine from and the function of which is essentially normal, neither of these measures seems to be justifiable.

Another situation with which the surgeon may be confronted is that presented by the inaccessibility of the kidney, which in turn may be due to the extreme obesity of the patient, to the large size of the organ, to an undue shortness of the pedicle making delivery of the organ impossible, to the dense adhesions resulting from previous operation, or to a combination of these factors. To these difficulties I might add that which is encountered in a horseshoe kidney, where, owing to numerous large aberrant vessels, access to the interior of the organ is difficult or unsatisfactory. Under such circumstances I believe it may sometimes be quite impossible to remove a stone, or that in attempting to do so one may jeopardize the kidney or even the patient. Here again the question of deliberately taking out the kidney must be well considered, as if one fails to remove the stone, subsequent operation may be required. If the case is difficult to handle on the first occasion one can be very certain that it will present no easier a problem later on.

In a few instances where the stone has been too large to extract safely through a pyelotomy incision and where nephrotomy seemed unwise and nephrectomy unwarranted, I have yielded to the temptation to crush the stone [illegible] as presented. In the course of [illegible] in one case in two others the stone was readily crushed with a heavy clamp and apparently all the fragments removed. But in [illegible] these cases in part. I believe that the few small fragments which were left behind became so covered with fibrin, owing to the free bleeding, that they could not be detected with a metal instrument.

It has been already pointed out that the attention to and the performance of certain details may [illegible] more careful pre-operative study, more painstaking search for other [illegible] of the first, avoidance of bleeding, and irrigation of the renal pelvis have all been mentioned. In addition to these measures there are two others which are sometimes of value. One is the old fashioned, but still useful method of "needling" the kidney. While this may be done with the eye-end of a large straight needle, I find that the rounded end of a small flexible silver or copper probe is far superior. Its bluntness is no bar to its insertion into the kidney cortex, and for this very reason it is safer than a more pointed instrument. Furthermore, it can be bent so as to go in any direction. Having a general idea of the location of the stone one can insert the probe directly into the suspected calyx and finally elicit that welcome grating sensation which he has previously failed to get; or with an instrument in the pelvis grating against a stone which cannot be grasped, the localization of another surface of the stone with the probe will sometimes expedite its extraction by way of the cortex in other words, by partial nephrotomy. I cannot emphasize too strongly the value of this method of approach to a stone under certain conditions. The pyelogram may or may not have demonstrated a dilated calyx, but unless the stone has remained entirely in the pelvis, such a thin walled calyx is pretty sure to exist. Its location may often be discovered with the probe, the insertion of which will show that its walls are very thin and may be widely

opened for the extraction of the stone. Small clamps are then inserted into the calyx, using the probe as a guide, and the stone grasped without difficulty. I have never found it necessary to suture the rent made in such a calyx, nor have I seen any untoward results either immediate or remote.

Finally I wish to speak of a procedure which, under certain circumstances, may be of indispensable value in the search for stones in difficult cases. I refer to the use of the fluoroscope, either by the surgeon himself, or by the roentgenologist during operation. This has been used in the Mayo Clinic for a considerable time and with very satisfactory results. In fact, I was recently told by one of the surgeons of St. Mary's Hospital that their reliance upon this means of locating stones was now so great that they could safely feel that every calculus had been removed if and when the roentgenologist reported that no more shadows could be seen in the kidney. Although I feel that this may be a somewhat optimistic view of the possibilities offered by this method of examination, it certainly shows that the technique has been brought to a high state of development.

While my experience with the fluoroscope has not been extensive, I have found it of tremendous value in certain cases. We have used a small portable machine and have had the fluoroscopic examination performed by our roentgenologist. He has taken pains to accustom his eyes to the light conditions by wearing dark glasses some time before his services were required. After delivering the kidney from the wound the X-ray apparatus is brought to a suitable distance from the patient's abdomen, a sterile sheet being draped over the tube. The roentgenologist arranges his fluoroscopic screen, also draped in a sterile sheet or towel, close to the patient's back. Stones of any considerable size may be readily seen; small calculi may require considerable search. Under the direction of the roentgenologist the surgeon is then able to touch or grasp the stone by means of a metal instrument inserted into the pelvis or into a calyx. Sometimes another instrument or even the surgeon's finger, outside of the kidney, acting in conjunction with that in the kidney, will hasten the location and the actual seizure of the stone with a clamp. In a few instances of multiple small calculi, stones which defied my every effort at localization, either because of their position or their coating of fibrin, have been successfully removed. In certain other cases, however, the roentgenologist, after careful search, has reported that no more calculi were to be seen. But subsequent roentgenogram has shown one or two small stones remaining, a fact which demonstrates that even the fluoroscope with a competent observer behind it is not infallible. I believe, however, that the roentgenologist must be especially trained in this particular type of case. It is comparatively easy to see the outline of a large mass of bismuth in the stomach or intestines, but it is a far more delicate matter to detect a faint shadow the size of perhaps a grain of rice in the kidney, and yet this is the very thing we would like to have located with accuracy. Another feature of fluoroscopy which is essential is that the kidney must be delivered entirely out of the wound, so that no other tissue intervenes between it and the tube or screen. The frequent impossibility of this is well known, so that one cannot tell until the time comes whether the radiologist can perform his part or not. If the kidney cannot be delivered from its bed, the overlying tissues both bony, muscular, and fatty will prevent a clear view of the organ. I believe it is possible that this difficulty may eventually be overcome and that this method of examination is capable of being developed into one of the most valuable at our disposal for the certain reclamation of every stone which the kidney contains.

From what has gone before we have seen that stones may be left in a kidney from which they were all supposedly removed with disappointing frequency, in spite of every means which one may adopt. It is therefore clear that a roentgenogram during convalescence is absolutely essential if one is to know the exact state of affairs before dismissing his patient as cured. The question now will be asked, What is to be done when this roentgenogram shows that one or more stones have been left behind? Should the patient be told

the facts and should a second operation be advised? With very few exceptions I believe it is highly desirable, and even necessary, that the patient should know the exact situation. If he is of average intelligence and if the relationship between himself and the surgeon is all that it should be, this information will be accepted in the proper spirit. If the situation is not made clear an attack of renal colic or the spontaneous passage of a stone shortly after the operation may easily lead to an embarrassing situation.

The question whether a second operation should be performed is one which should be looked at from various points of view. In the first place the patient may refuse, in which case the incident is closed, at least for the time being. If the patient is a poor risk or for any reason took unkindly to the first operation, one would hesitate to submit him to further risks. If a nephrotomy has been done and convalescence has gone on without the advent of secondary hæmorrhage the surgeon would, indeed, be bold to advise the tempting of Providence a second time. Furthermore, I believe, although I have seen no case to prove it, that the reopening of a previously nephrotomized kidney would very materially increase the amount of destruction to the organ which the first operation produced.

On the other hand, when the patient is agreeable to the proposition, if he is a good risk and stood the first operation well, if the kidney is not too inaccessible, and if the size, shape and position of the remaining stone or stones make the probability of subsequent spontaneous passage small, then I would advise a second operation. Having had occasion to so advise in several cases, I have performed the second operation 10 days or 2 weeks later. By this time the patient is well over the effects of anæsthesia, the possibility of infection is gone, and clots have become pretty well organized. On the other hand, adhesions are so delicate as to offer no hindrance to a rapid approach to the kidney and one's only difficulty lies in the increased thickening of the various structures from œdema and processes of repair.

My experience has been that the recovery of stones at the second operation is apt to be easier than was expected, and I have had only one [illegible] in which a second operation showed the [illegible]. This case has been followed carefully and the remaining stone has finally been spontaneously passed, aided meantime by the [illegible].

Before bringing this paper to a close I wish to say a few words on the choice of operation. Those cases which obviously require nephrectomy [illegible]. But since it has been shown that the number of stones subsequently found in a kidney, whether they are actual recurrences or "left overs" from a previous operation, is very high, and when one considers that this is true whether after pyelotomy or nephrotomy, the decision as to which operation to employ may be difficult. In a few cases the size and number of the stones or their position may leave one in no doubt that nephrotomy is the only possible procedure. On the other hand, when stones are so large or so numerous as to require this operation for their removal it will usually be found that the kidney is dilated beyond hope of recovery, that its urine is badly infected, and that its function as shown by the phthalein test is of little consequence. Under these conditions the kidney should be removed, for as W. J. Mayo[1] has remarked: "One of the most common causes of recurrence of stone has been the attempts to conserve a badly damaged kidney which was of little use functionally and a continuous menace to the future health of the patient."

Any series of nephrotomies will show a high percentage of disasters, fatal or otherwise. Among the 70 nephrotomies performed at the Massachusetts General Hospital from 1897 to date there was an operative mortality of 5.7 per cent, comprising 4 cases, of which 2 died as the result of secondary nephrectomy for hæmorrhage. Eleven of the series (15.7 per cent) had secondary hæmorrhage, requiring nephrectomy in 3 instances, while in 8 the bleeding ceased either after packing or spontaneously. Lest it be thought that our experience is unique, I find that Bevan has

had to do secondary nephrectomies in 8 or 10 cases within one or two weeks after nephrotomy, and that W. J. Mayo (loc. cit.) discussing 40 nephrotomies, says that "several had hæmorrhages after operation and in four it was necessary to do nephrectomy to save their lives."

The high percentage of recurrences after this operation, the very considerable chance of secondary hæmorrhage often requiring nephrectomy for its relief, and the undoubted fact that the kidney will be left in a seriously impaired condition, if indeed it was not so already, should make us stop and consider carefully whether it is advisable.

Turning to pyelotomy, we find a brighter picture. In the first place, the mortality is almost negligible. In one series of 206 cases at the Mayo Clinic, Braasch (loc. cit.) reports not a single death. In our clinic at the Massachusetts General Hospital we have lost but 2 patients after this operation in the past 11 years. Postoperative fistula of any considerable duration is rarely, if ever, seen, and it is hard to believe that the comparatively little disturbance of the renal cortex or of its blood supply results in further damage to the organ. Therefore, although the difficulties of removing stones from a kidney through a pyelotomy incision may tax the surgeon's uttermost skill and ingenuity, and although it has been seen that in spite of this effort the number of stones subsequently found is high, one should have no hesitation in selecting this as the operation of choice whenever possible.

SUMMARY

I might summarize my remarks as follows:

1. There is an unfortunate paucity of investigation on the matter of recurrent or overlooked renal calculi and it would be desirable to have various observers in different clinics undertake such an investigation.

2. Roentgenographic examination during or very shortly after convalescence is essential for the accuracy of the results in such a piece of work.

3. While the few data which are at hand show that stones are subsequently found in the kidney after operation in a surprising number of instances, it is impossible to say which of these stones are "recurrences" and which are "left overs." Actual recurrence is unquestionably very frequent.

4. The complex character of the interior of the kidney, hæmorrhage from its mucosa, and the comparative inaccessability of this organ in many cases contribute to the difficulties in removing all stones.

5. Although various procedures may be resorted to for this purpose, none is infallible. It would appear that the fluoroscope offers the most promising prospects for success.

6. Pre-operative study cannot be too painstaking, nor must the possibility of superimposed shadows of calculi be overlooked.

7. A second operation for the removal of remaining stones is advisable in most cases and should be done soon after first operation.

8. Pyelotomy is unquestionably the operation of choice and is often advantageously combined with partial nephrotomy.

PRIMARY TUMORS OF THE URETER

By PAUL W. ASCHNER, M.D., New York

A SURVEY of medical literature reveals 47 cases of primary epithelial tumors of the ureter. Of these only four were squamous-celled carcinomata. In a study by Kretschmer, 44 cases of leucoplakia of the urinary tract were compiled. A patient presenting both of these rare conditions came under my observation and care. The history and findings are herewith presented.

Case No. 210343—H. W., male, age 38, was admitted to the surgical service of Dr. Edwin Beer, May 12, 1911.

Three weeks before admission he had an attack of severe stabbing pain in the right flank radiating downward and [illegible] by repeated vomiting, chills, and temperature of 105°. The attack gradually subsided in 5 days. The patient thought he passed a stone, followed by bloody urination for a few hours. Dull, constant pain in the right upper abdomen had persisted since, made worse by bodily motion and ingestion of food. There was marked nocturnal frequency. The only point of interest in his past history was that he had a kyphosis since childhood.

Physical examination showed [illegible] lumbodorsal kyphosis, tenderness in the right costovertebral angle. The urine was cloudy, showed some albumin, many pus cells, and a few red blood cells. The roentgen examination showed one large, and three smaller calculi in the right kidney. The smallest appeared in the periphery, the others in the pelvis. Lesion of the [illegible] and second lumbar vertebræ was seen.

Cystoscopy showed an intense diffuse cystitis with flakes of pus and fibrin adherent to the bladder wall and marked œdema of the sphincteric region. Ureter catheters were passed to both pelves, and a good flow obtained from both sides. The right side yielded pale, turbid urine with no indigo excretion. It contained much pus, 0.3 per cent urea, culture negative. The left side yielded a clearer, more concentrated urine with pale indigo excretion in 25 minutes. It contained some leucocytes, 0.9 per cent urea, culture negative.

The phenolsulphonephthalein test showed 30 per cent excretion in 2 hours.

Blood chemistry showed urea nitrogen 26.6; incoagulable nitrogen 34.7; [illegible]

Blood Wassermann negative.

In view of the poor functional power of the left kidney as shown by the [illegible] test and the presence of some pus in the urine from the left kidney, a conservative operation was planned. Because of recent fever and chills, pyelograph[illegible] omitted.

[illegible] May 16. An oblique lumbar incision. It[illegible] normal size, its pelvis tremendously enlarged and dilated. At the ureteropelvic junction an indurated [illegible] about 1.5 centimeters in length was felt and [illegible] kidney was delivered with some di[illegible] of adhesions, and the pelvis emptied of its fluid content by an aspirating syringe and needle. Culture of this fluid subsequently showed hæmolytic streptococci. An incision 5 centimeters in length [illegible] made on the anterior aspect of the pelvis in a longitudinal direction, and thre[illegible]

The fourth calculus, localized by palpation in a calyx near the periphery at the middle of the [illegible] through a centimeter in[illegible] of the cortex. This incision served for a drainage tube later. Fluoroscopy by Dr. Bendick show[illegible] had been removed. The ureteropelvic junction was then examined and found to be the [illegible] stricture 1.5 centimeters in length, admitting a small probe. The pelvic incision was therefore extended through the strictured area. The density of the scar tissue aroused my curiosity and I therefore excised a [illegible] section for microscopic examination. [illegible] and a large ureter catheter passed well down the ureter and led out through the [illegible] pelvis. The pelvis was then closed with interrupted sutures, and reinforced by fatty tissue. A small tube was introduced through the nephrotomy wound. Rubber dam was placed in front and behind the kidney and the greater part of the wound was [illegible] in layers.

The stones consisted of calcium [illegible] oxalate, and ammonio-magnesium phosphate. To our great surprise the tissue removed from the ureter stricture proved to be [illegible] cinoma. It was, therefore, indicated to remove the ureter and kidney. If a frozen section had been made the complete operation could have been done at the first procedure.

[illegible] anæsthesia. The technique of nephro-ureterectomy [illegible] modification, namely, that the ureter was [illegible] extraperitoneally and divided close to the bladder [illegible] and liberation of the lower ureter before doing the nephrectomy had these advantages: (1) it minimized the risk of sending tumor cells down through

Fig. 1. Leucoplakia of renal pelvis.

the ureter during the manipulations necessary for the freeing of the kidney and upper ureter; (2) it eliminated one shift in position of the patient necessitated by the technique hitherto described; (3) it minimized the chances of infecting the anterior wound after working in the infected field produced by the previous operation (the pelvis contained fluid showing hæmolytic streptococci).

Through a three-inch low pararectus incision, the ureter was isolated extraperitoneally, divided between ligatures close to the bladder, and the stump carbolized. The proximal part was freed as high up as possible, dropped back, and the wound closed with a small tube drain into the retroperitoneal space.

The patient was then turned on his side. The wound of the former operation was reopened and found to be extensively infected with much pus and fibrinous exudate. The upper ureter was freed and the whole ureter brought out. The kidney was then easily extirpated, the vessels being isolated and ligated separately. The wound was packed with a Mickulicz tampon.

Gross pathology. Specimen consists of the right kidney and ureter. The kidney is about twice the normal size and its surface shows a fibrinopurulent exudate, the result of infection following the previous operation and drainage. On its convex border at about its middle is a small nephrotomy wound, 2 centimeters in length, the tract leading into the kidney pelvis and showing necrosis and inflammation in the adjoining parenchyma. The pelvis and ureter are greatly dilated and their walls markedly thickened. At or below the ureteropelvic junction is an annular constricting growth irregular in outline, hard, 1.5 centimeters in length and showing a somewhat elevated, red, granular surface. The pelvis is widely open (previous suture line reopened during course of second operation). On splitting its anterior aspect upward, continuing the pyelotomy wound, the pelvis is seen to be bifid, one part leading to the upper, the other to the lower half of the kidney. The upper pelvis and calyces present a fairly normal surface, except for some broken-down, adherent blood clot. The lower pelvis and calyces, however, contain grayish white, somewhat greasy flakes, free, or loosely adherent to the mucosa. The latter is almost completely covered by dull, grayish white, slightly elevated, irregular membrane which can readily be peeled off in flakes. At the entrance to the upper pelvis and on the septum between the two is a more glistening, finely wrinkled, parchment-like area. Midway between this patch and the neoplasm is a less well defined area with no wrinkling or elevation. The condition is one of leucoplakia.

It is difficult to be sure whether the tumor is at the ureteropelvic junction, or whether it was at a point below, with subsequent dilatation of the ureter above the obstruction. The ureter below the growth shows no gross evidence of leucoplakia, although the surface is very smooth and lacks the normal markings. The kidney tissue itself is fairly preserved and shows no evidence of marked inflammatory changes. (See Figs. 1 and 2.)

Microscopic pathology.[1] 1. Section through leucoplakic patch of pelvis (Fig. 3). This presents a perfect reproduction of epidermis as it exists in the less exposed, less thickly covered parts of the body. On the surface is the desquamating hyaline layer of flattened fused cells without nuclei (stratum corneum). The stratum lucidum is not present distinctly. Then comes a layer of two or three cells deep, with flattened polygonal cells, filled with deeply staining granules of keratohyaline substance (stratum granulosum). Next is a layer four to eight cells deep, of polyhedral cells becoming columnar in the depth and showing distinct intercellular bridges (stratum germinativum). The stratum cylindricum (deep columnar layer) appears to rest on an even, well-defined basement membrane. There is no tendency to papilla formation. The underlying connective tissue presents many blood vessels, lymph spaces, and foci of round cell infiltration.

2. Section through pelvis (or ureter) near the neoplasm (Fig. 4). The sharply defined layers described above are wanting; nevertheless the epithelium is flattened, polygonal, of the prickle cell type. The deeper cells are swollen, irregular in outline and

[1] Sections submitted to Dr. J. H. Globus for the photomicrographs.

Fig. 2. Leucoplakia of renal pelvis, carcinom

vacuolated. The sub-epithelial tissues show ... inflammatory infiltration.

3. Sections through the neoplasm (Figs. 5 and 6). The epithelium has taken on a disordered rapid growth. The cells on the surface are large, irregular, vacuolated with large irregular vacuolated, deformed and mitotic nuclei. Infiltrating strands spread into the inflamed vascular connective tissue down to and even into the muscle layers. In the depths bizarre forms are seen, and tendency to whorl formation, with hyaline centers (pearls). It is a typical squamous-celled carcinoma.

4. Section through lower part of ureter (Fig. 7). The surface presents a more normal, wavy outline, ... transitional type. The more superficial ones ... marked round-cell infiltration. There is no evidence of leucoplakia

The specimen, therefore, is one of a hydronephrotic, infected kidney with bifid pelvis, with leuco... ureter.

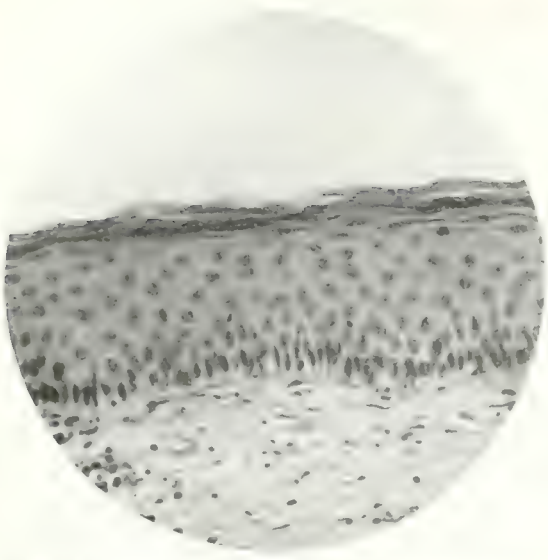


Fig. 3.—Leucoplakia of renal pelvis, section showing well-defined layers of epidermis.

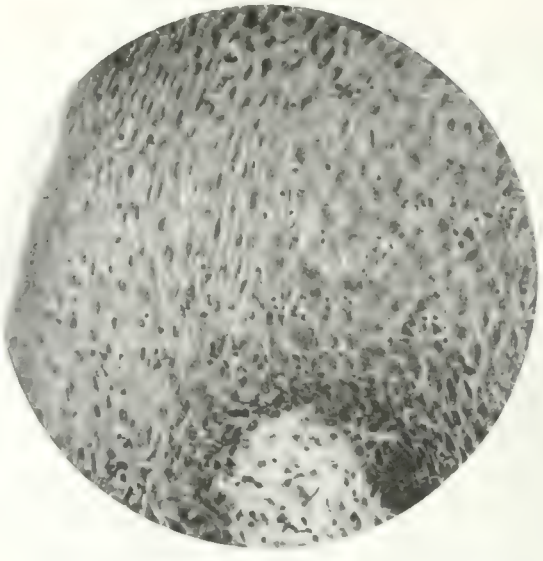


Fig. 4.—Leucoplakia in vicinity of the neoplasm.

Subsequent course.—In view of these findings it was reasonable to suppose that the pus in the opposite kidney was due to a leucoplakic condition. After operation flakes in the urine were examined and proved to consist of desquamated squamous epithelium.

The abdominal wound healed with little discharge of pus from the drainage tract. The lumbar wound was treated with Dakin's solution and healed by granulation. The patient was discharged on July 12, about 2 months after his admission.

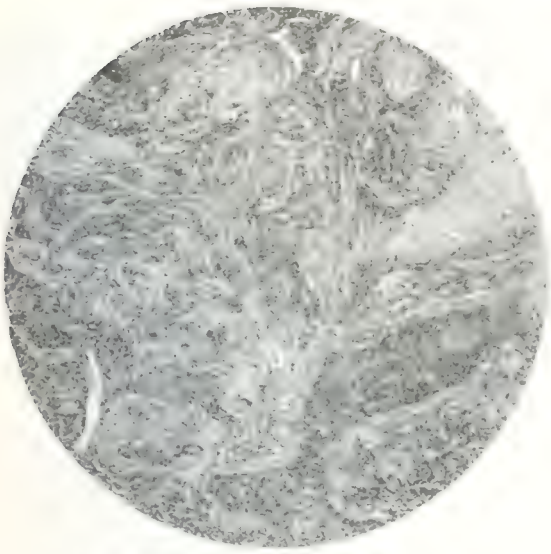
Vesical symptoms and cloudy urine continued, however. Cystoscopy showed two well-defined, glistening, silvery white areas behind the trigone, in addition to a diffuse cystitis. Specimens removed from these areas showed typical leucoplakic changes.

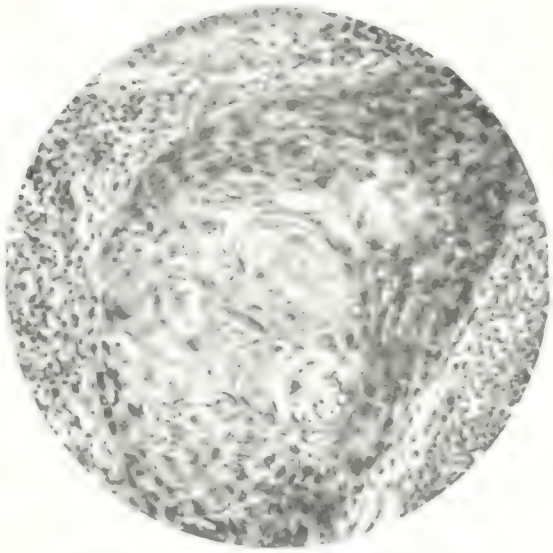
In November, 1921, the patient was presented before the Section of Urology, New York Academy of Medicine. He was suffering considerably from the cystitis and vesical leucoplakia. In discussion Dr. Benjamin Barringer suggested radium therapy and at my request he made an intravesical application in January, 1922. The patient reacted badly to the treatment. In February uræmic symptoms developed, but the patient refused hospital care and he died of renal insufficiency at his home. Autopsy was, unfortunately, not obtainable. The remaining kidney it will be remembered was poor at time of operation.

It is interesting to speculate upon the sequence of pathological events in this case. It seems probable that the leucoplakia of the urinary tract preceded the formation of calculi. These were of the soft variety often seen in infected kidneys with stasis, and had none of the branching or coral form seen in primary pelvic stones. The passage of a stone or the ulceration due to impaction added to the irritation of infection at the ureteropelvic junction or at a point shortly below it. With leucoplakia existing at this point, the trauma and chronic inflammation stimulated the squamous epithelium to proliferate and develop into an epithelioma. The tendency of epidermis to develop malignancy when out of its normal environment is shown by an experiment performed by Pribram and Finger.[1] A scrap of epidermis transplanted in the peritoneum developed into a tissue like a horny cancer.

It is not my purpose to enter into a detailed discussion of the etiology and nature of leucoplakia. The most authoritative articles on the subject are referred to in the bibliography. Marchand first believed it was a replacement of the normal epithelium by a process of invasion from the true skin. Albarran explained it on the basis of embryonal heterotopia. Hallé regarded it as a true metaplasia, and it seems to me that the weight of available evidence is in favor of this view. Ziegler noted its almost constant

[1] Arch. f. klin. Chir., 1921, cxviii, 708.





association with chronic inflammatory processes of tuberculous or non-tuberculous origin, although Leber believed it could occur congenitally, and Kischensky pointed out that in rare instances all evidence of inflammation was lacking. Most authors, including Kischensky, Wendel, Weichselbaum, and Kaufmann, felt that its presence predisposed to development of squamous-cell carcinoma. Hallé was strongly inclined to this view.

That it is not an indispensable forerunner of malignant growths of this type, however, is evidenced by the fact that of nineteen such tumors of the renal pelvis collected by Spiess, leucoplakia was present in only three. In 90 cases of bladder tumors collected by Hinman and Gibson leucoplakia was present in only 6.

An analysis of the data available in the reported cases of primary ureter tumors is presented in table form, and the observations of diagnostic and therapeutic value summarized. The cases are grouped according to the pathology. The case numbers in the tables correspond to the bibliographic numbers.

I. Papillomata 21
II. Papillary carcinomata 1
III. Non-papillary carcinomata 14
  A. Squamous cell 4
  B. Carcinoma solidum seu medullare . . . . . (10)

Of the 21 cases, 8 are reports of autopsy specimens. Eight cases occurred in individuals under 45 years of age. Eleven were in males, 8 in females. Hæmaturia was known to have occurred in 11, hydronephrosis in 10.

The diagnosis was established by autopsy in 10. Two of these were cases operated upon without discovering the lesion (one, nephrotomy; the other, nephrectomy, and exploratory cystotomy). In 4 cases the tumor was seen protruding from the ureter orifice by cystoscopic examination prior to operation. In Le Dentu's case nephrotomy was done with resultant persistent fistula. An obstruction in the ureter was demonstrated by the failure of methylene blue to appear in the bladder urine after its injection through the lumbar fistula. Cystoscopy then revealed a fringe of papilloma protruding through the ureter orifice. Marion destroyed a papilloma near the ureter orifice by fulguration, but bleeding continued. He re-examined, saw blood issuing from the orifice, and encountered an obstruction at 5 centimeters. In Culver's case the kidney had been removed by another surgeon without stopping the hæmaturia, and cystoscopy showed obstruction and bleeding at 23 centimeters. A ureterogram demonstrated that the ureter

Fig. 5.—Transitional epithelioma of lower ureter.

extended 4 centimeters up above the end of his catheter. Beer made the diagnosis by excluding calculus, by finding a constant obstruction at 7 or 8 centimeters, and by being able to induce bleeding with the catheter during a free interval.

The following operations were performed in attempts to diagnosticate or cure: For tumors protruding into the bladder: transvesico-ureteral removal, 2; transvesical resection with re-implantation of the ureter, 2; all successful. In one of the first group a nephrectomy was done for secondary pyelonephritis. For the invisible tumors: nephrotomy, 2; nephrectomy, 4; of which only one met the indication because the growth was in the upper ureter. In Suter's case there was a series of operations: exploratory cystotomy, exploratory on kidney for essential hæmaturia, nephrectomy, and finally ureterectomy which cured the patient. Walter did a primary ureterectomy, leaving the kidney in. Culver did a secondary ureterectomy, the kidney having been removed by another surgeon. Secondary nephro-ureterectomy was done in Le Dentu's case, after nephrotomy. Primary aseptic nephro-ureterectomy was done in Beer's case only. Marion apparently cured his case by fulguration with the electrode at the bleeding ureteral obstruction.

Neelsen's specimen was of unusual interest. The ureter bifurcated 5 centimeters above the bladder. The lower branch and pelvis showed no abnormality. The tumor was located in the upper part of the upper branch and the corresponding portion of the kidney presented marked ectasis with destruction of the parenchyma. The diagnostic difficulties under such circumstances are apparent. Ureteral calculus was associated with the growth in four instances.

II. PAPILLARY CARCINOMATA OF THE URETER

Of 12 cases, 5 are reports of autopsy. Eight cases occurred in males, 4 in females. Only one patient was under 45. Hæmaturia was noted in 11, and hydronephrosis in 8 cases.

In the cases of Finsterer and of Judd and Struthers a growth was seen cystoscopically. Richter diagnosed tumor by the presence of atypical epithelial cells in the urine. Chevassu and Mock saw blood issuing from the ureteral orifice and encountered obstruction at two levels with increase of bleeding upon manipulating the catheter. Chiari found an obstruction at 8 centimeters and obtained only some bloody exudate.

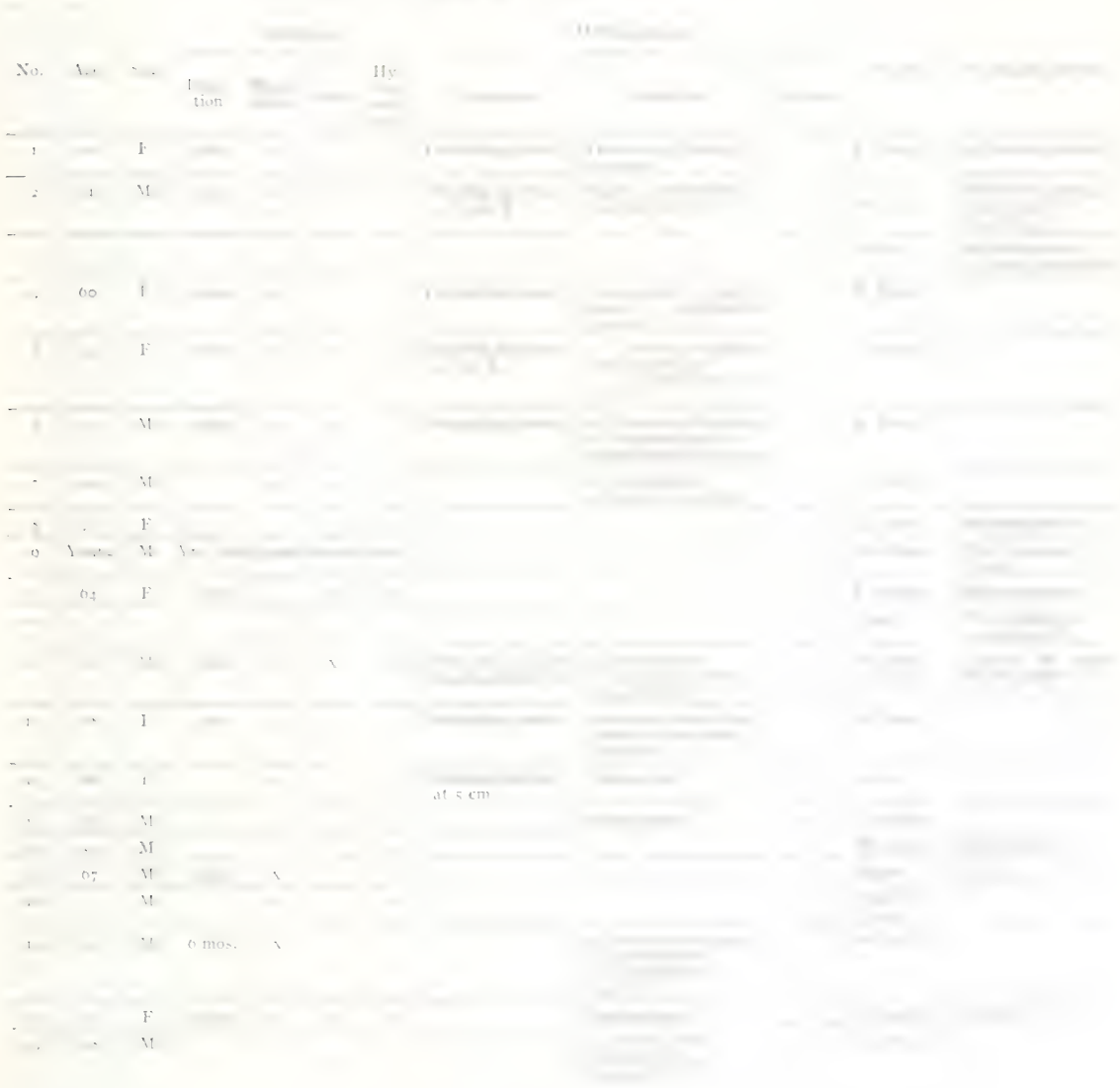
The operative procedures employed were the following: In Finsterer's case 14 centimeters of the lower ureter were resected and the proximal end reimplanted. At the time of the report the patient was apparently well, but the author could not exclude the presence of other tumors higher up. Nephrectomy was performed three times, followed by ureterectomy in two (Van Capellen, Judd, and Struthers). In Israel's case autopsy after splenectomy and nephrectomy revealed the true condition. Primary nephro-ureterectomy was performed by Chevassu and Mock, and Chiari. It was attempted by Metcalf and Safford, but the case was inoperable.

Ureteral calculus was present in two cases. Periureteral infiltration, regional lymph nodes or distant metastases (in spine, liver, or lungs) were present in 5.

III. NON-PAPILLARY CARCINOMATA OF THE URETER

There are 14 of these, of which 7 are autopsy reports. Four were squamous-cell

I. PAPILLOMATA OF THE URETER



carcinomata. No mention of associated leucoplakia is made. Five occurred in males, 9 in females. Hæmaturia was noted in [illegible] and hydronephrosis in 8. Four were below the age of 45.

A protruding tumor was observed cystoscopically twice, and obstruction to the ureter catheter twice. In Quinby's case, the ureterogram showed a large filling defect corresponding to the site of the tumor.

The kidney was tapped once, nephrotomy was performed once, and nephrectomy once. In two cases exploration proved the cases inoperable. In Quinby's case ureterectomy and subsequent nephrectomy yielded a [illegible] result.

In 11 instances periureteral extension or metastasis made the case hopeless. The disease apparently spread early and extensively. Calculus was noted twice.

Jona's case of tumor arising in a small diverticulum was classified as a benign pap-

II.—PAPILLARY CARCINOMATA OF THE URETER

No.	Age	Sex	Symptoms: Duration	Hæmaturia	Pain	Hydronephrosis	How Treated: Cystoscopy	Operation	Autopsy	Situation	Associated lesions
22	[illegible]	M	[illegible]	X					X	L. lower	Spinal metastasis
[illegible]	[illegible]	F	[illegible]	[illegible]	X	X		1. Nephrectomy 2. Ureterectomy, uncomplicated recovery		R. lower	
24	[illegible]	M	[illegible]	X		X	Obstruction and bleeding; two levels	Nephro-ureterectomy, recovery		L. middle	
[illegible]	[illegible]	F	[illegible]	X			Obstruction and bleeding; no cystoscopy	Nephro-ureterectomy, recovery		L. lower	
[illegible]	[illegible]	M	[illegible]	X			Protruding tumor	Lower ureter resected Re-implantation, recovery		L. lower	
[illegible]	[illegible]	F	[illegible]	X	X	X		Splenectomy and Nephrectomy	X	L. Multiple infiltrating	Metastases
28	[illegible]	M	2 yrs.	X		X	Protruding tumor	1. Nephrectomy 2. Ureterectomy and partial bladder resection recovery		R. lower	
[illegible]	73	M	[illegible]			X			X	L. upper	
[illegible]	47	M	[illegible]		X	X		Nephrectomy and partial ureterectomy		Lower	Ureteral calculus villi in pelvis
31	[illegible]	M	[illegible]	X	X	X			X	L. lower	Calculus Metastases
[illegible]	[illegible]	F	[illegible]	X		X			X	R. lower	Metastases
[illegible]	68	M	[illegible]	X		X	Atypical epithelial cells in urine		X	L. lower	Metastases

illoma by Spiess, but from the author's description I believe it was an early carcinoma. Quinby called his case a mesothelioma, but from the pathologist's report of the histology it appears to be a carcinoma.

DIAGNOSIS

The chief manifestations of tumors of the ureter are hæmaturia, pain due to either renal colic, chronic distention of the kidney pelvis, or periureteral extension, and hydronephrosis. The difficulty of making a pre-operative diagnosis of ureter tumor is shown by the fact that it was attained in only four cases in which no tumor was visible cystoscopically, and in which no previous therapy or operation pointed to the true lesion. From a study of the cases collected, the following findings, separately or in various combinations, are suggestive. Two or more cystoscopic examinations are usually required to secure the necessary data.

I. Cases with visible tumor. A papillary tumor may be found in the trigonal or paratrigonal area, or fine finger-like projections may form a corolla about the ureteral orifice, or a pedunculated tumor may protrude from the orifice constantly or intermittently with the efflux. If cystoscopy is done in a free interval (i.e. no bleeding) one would be likely to attribute the hæmaturia complained of by the patient to the visible tumor or tumors. If cystoscopy is done while bloody urine is being voided, however, one will be surprised to find the blood coming, not from the visible tumor, but from the ureteral orifice on the corresponding side. In some cases with a clear or nearly clear bladder urine, the ureter catheter passing an obstruction near the orifice will yield a bloody urine.

In these cases of visible papillary tumors, a growth higher up in the ureter or kidney pelvis must be suspected. If visible tumors have been removed by forceps or fulguration and bloody efflux from the ureter continues or recurs, the diagnosis is practically certain.

II. Cases with no tumor visible. If cystoscopy is done while the patient is in a free interval, an obstruction in the ureter which bleeds on manipulation of the catheter is suggestive, but calculus must be excluded by X-ray and wax tipped bougie. If the catheter

III.—NON-PAPILLARY CARCINOMATA OF THE URETER

passes an obstruction and evacuates a hæmatonephrosis, one should strongly suspect a primary pelvic tumor with ureteral implantation.

If the examination is made during a period of hæmaturia, bloody efflux from the ureter, with obstruction to the catheter, and increased bleeding upon manipulation is highly suggestive. If on passing the obstruction clear urine is obtained, the diagnosis is practically certain.

A ureterogram may demonstrate a definite filling defect with dilatation above it.

If a nephrectomy has been performed and bleeding continues from the ureter on the same side, the diagnosis is practically certain and may be strengthened by a number of the above findings.

It is evident from the many possible cystoscopic findings that a positive diagnosis is rarely attainable. Ureteral calculus, tuberculous stricture of the ureter, and even simple stricture of the Hunner type must be excluded. In the only case of undoubted Hunner stricture which I encountered, there were attacks of hæmaturia, and bleeding could be induced by manipulating the ureter catheter at the site of obstruction. The subsequent complete relief obtained by ureteral dilatation cleared up the situation.

TREATMENT

In the case of visible tumor proven benign by biopsy, fulguration may be employed, but if ureteral bleeding continues or if there is no visible tumor, aseptic nephro-ureterectomy as described by Dr. Beer is the procedure indicated. A less extensive operation does not meet the indications because, first, the kidney is probably rendered useless already, [illegible] pelvis and ureter, third, the tumor may be malignant. A partial resection of the bladder may be necessary in addition, when the growth involves the ureteral ostium.

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ELUSIVE ULCER OF THE BLADDER

A Further Report

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IN a previous paper on the surgical treatment of elusive ulcer of the bladder[1] cases were reported in which the diagnosis was verified by operation and histological examination of specimens obtained.

I now have, including the previously reported cases, the records of 14 cases. Because of the gradually increasing interest in this subject, it was thought advisable to study this larger group of cases with the idea of attempting to bring out any possible new phases of the subject and also to review the previously published cases to determine, if possible, the results of treatment with special reference to the end-results.

The time that has elapsed since the first 5 cases were operated on may not be considered very long (21 months the longest and 16 months the shortest), yet it seemed worth while to get in personal communication with these cases to determine just what has been accomplished.

Likewise it was thought desirable to ascertain the status of the cases operated upon more recently with the same object in view. For this reason the patients were asked to call at the office for personal interviews and for urinary examinations. In some instances the patients lived too far away to report in person and their present status was obtained by personal correspondence. A summary of these cases is given at the end of the paper.

SYNONYMS

Much credit is due to Hunner who called attention to this lesion and outlined a definite surgical procedure in its treatment; namely, wide resection of the ulcer-bearing area. In his report he used the term "Elusive Ulcer" which has been somewhat confusing, since those who become interested in these cases immediately begin looking for something [illegible] are not at all elusive.

Practically every author writing on this subject has suggested a new name, which only adds to the confusion and multiplication of synonyms. Nitze, many years ago, suggested the term "Cystitis Parenchymatosa," but this has not met with much favor and the term has never been used.

ETIOLOGY

Up to the present time it can be stated that the cause of this lesion is unknown. Hunner suggested the possibility of a distant focus of infection as playing a rôle in the etiology, suggesting infection of teeth, tonsils, sinuses, and adenoids. Bumpus and Meisser, following the work of Rosenow, conclude that elusive ulcer and other infections of the urinary organs are due to focal infections harboring streptococci, which have a selective affinity for the urinary tract.

SEX

From the very start one striking feature has been that females have been much more frequently attacked than males. Thirteen of the 14 cases to be reported in this paper occurred in women and only one in a male. Hunner's series (25 cases) all occurred in females; Bumpus reported 15 cases, 13 of which were females; Keene reported [illegible] cases; Reed, 5, and Fowler, 3, all in women. Hunt reported 20 cases operated upon, 18 of which were females. The only large series of cases in males is reported by Frontz who in 26 cases, reported 23 cases in males and only 3 in females.

Hunt stated that since the teeth, tonsils, and sinuses are foci of infection common to both sexes, it seems that some additional etiological factor other than focal infection must explain the frequency of the lesion in the female and its rarity in the male.

[1] Surgical treatment [illegible] Am. M. Ass., 1917, lxviii, April 7.

[2] Read before the [illegible]

Marital state and pregnancy. Most of the authors are agreed that matrimony and pregnancy have no etiological bearing on this condition inasmuch as cases are seen in both the married and unmarried. Ten of the 14 cases are married and 3 have never been pregnant. These 3, with the 2 single women, make a total of 5 who have never borne children.

Careful pelvic examinations were made without finding pelvic pathology, hence lesions of the pelvic organs can be dismissed as etiological factors and also as factors in the production of the urinary symptoms.

AGE

It would seem from the table of ages that this is essentially a disease of adult life. The youngest patient in this series is the one male, aged 24. The oldest patient was 61.

	Cases
21 to 30 years	2
31 to 40 years	6
41 to 50 years	5
51 to 60 years	0
61 to 70 years	1

PREVIOUS OPERATIONS

In no department of surgery is the value of careful pre-operative study so apparent as it is in the field of urological surgery. Genito-urinary surgeons are familiar with the large number of patients with urinary symptoms who have been subjected to various abdominal and gynecological operations without obtaining relief from their symptoms. The large numbers of patients suffering from various kidney lesions, such as stone, tuberculosis, and pyelitis, who have sacrificed their appendices and various pelvic organs, are evidences either of careless diagnosis or insufficient pre-operative study. Cases of elusive ulcer are no exception to this statement.

Thirteen of the 14 cases gave a history of previous surgical operations. These operations can be classified into two groups. In the first group can be arranged the operations which had no connection with the bladder condition and hence have no distinct bearing on this subject. In this group we find 4 cases—3 females and 1 male—who had the following operations: tonsillectomy (2 cases); tonsillectomy and eye operation (1 case); haemorrhoidectomy and operation for enlarged left testicle (1 case).

The remaining 9 cases had all been operated on previously for relief of their urinary symptoms, but the operations failed to relieve the bladder distress. The urinary organs had been operated on in 2 of these cases. In one case a nephrectomy was performed under the mistaken diagnosis of renal tuberculosis. This case was described in detail in the previous report on this subject.[1] The second patient was operated on and was told that a tumor of the bladder had been removed. The remaining cases had the following gynecological and abdominal operations:

Case 1. Appendectomy, resection of ovaries and shortening of round ligaments.

Case 6. First operation, suspension of uterus; second operation, perineorrhaphy; third operation, hysterectomy; fourth operation, removal of urethral caruncle.

Case 8. Appendectomy and left ovariectomy. Hysterectomy advised just prior to coming under observation.

Case 10. First operation, appendectomy and operation for gastric ulcer; second operation, perineorrhaphy; third operation, perineorrhaphy.

Case 11. First operation, curettement and ovarian tumor removed; second operation, salpingectomy and oophorectomy.

Case 12. Ventral suspension.

Case 13. Curettage.

There was only one patient who had never been subjected to any sort of surgical operation—a female (Case 2).

PATHOLOGY

All the specimens removed at operation were subjected to careful histological examination. The microscopic picture was almost uniform. While the changes varied somewhat in extent and in minor details, the same general picture was found, as a rule, in all 8 cases. The ulcer-bearing area showed a loss of the epithelium. In several instances there appeared to be a flattening of the epithelium, so that, as the edge of the ulcer was approached, the epithelium was much

[1] Loc. cit

flattened and formed a very thin layer. In one case, the epithelium appeared to have changed to the flat, squamous type of cell. Some of these cells seemed to be hydropic. Occasionally the surface of the ulcer was covered with fibrin and many red blood cells were noted in some of the fibrin masses. The fibrin was not limited to the surface of the ulcer, but extended beyond the edge and over and on to the mucosa. At times red blood cells were seen adhering to the surface of the ulcer.

The most extensive changes were those found in the submucosa which showed many new formed blood-vessels and these were packed full of red blood cells. Round-cell infiltration was seen in the submucosa. There were areas in which the collections of round cells were very small; and in others, large masses of round cells were noted. Some of the sections showed these small, round cells closely crowded together and with the border rather sharply defined, and these areas resembled somewhat the collections of cells seen in so-called cystitis follicularis, rather dense and visible to the naked eye.

Round-cell infiltration was also seen occasionally between the muscle bundles. In several of the sections there were newly formed connective-tissue cells in the submucosa, and here and there the submucosa appeared definitely œdematous. In two of the sections, gland tubules were seen; and these differed in no way from the gland tubules in cases of cystitis glandularis. In one of the sections the cells forming the tubules showed secretion within the cell, so that they had the appearance of typical goblet cells. A combination of follicle formation and gland formation was not found in the same specimen.

The changes in the muscular coat were not so extensive as the changes in the submucosa. Occasionally areas of round-cell infiltration were noted, which, however, were not extensive. In several of the sections the muscle bundles were apparently separated by œdema.

A very striking change was that found at operation, the bladder wall showing an enormous thickening entirely out of proportion to the size of the ulcer. This was well marked that in several of the cases it was possible to foretell the exact location of the ulcer or ulcers before opening the bladder.

As a rule the peritoneal coat showing decided thickening.

The specimens in 3 cases were turned over to Dr. Dick for special bacteriological examination and he attempted to grow organisms from the ulcers. The technique employed was maceration of the excised ulcer-bearing areas of the bladder. This experiment showed the presence of bacillus coli in Case 1, streptococci in Case 8, and a few colonies of staphylococcus albus and many colonies of diphtheroid bacilli in Case 9.

SUMMARY OF SYMPTOMS

From a review of the histories it would appear that this is essentially a chronic disease. This, however, may be more apparent than real, and the long duration of the symptoms is undoubtedly due to the fact that although the patients had consulted many physicians and had submitted to many and varied surgical operations, the long period of illness was in reality due to the fact that the condition was not recognized. In one patient the symptoms had been present 17 years, during which period she had been operated upon four different times, the following operations having been performed: (1) suspension of the uterus, (2) perineorrhaphy, (3) hysterectomy, (4) urethral caruncle. Failure of the operative procedures is self-evident.

The shortest duration of symptoms was 11 months and occurred in the only male case in this series. A cystoscopic examination made a few days after admission to the hospital established the diagnosis, and operation gave complete relief of his symptoms.

These 2 cases, from the two extremes of disease duration, are rather striking, showing in the one instance how easy and simple it is to straighten out these cases if the diagnosis is made at once, as against a period of suffering for 17 years, a submitting to four surgical operations, and no relief of symptoms. There does not seem to be any uniformity in the duration of the disease as can be seen from the following table:

	Cases
11 months	1
1 year	1
2 years	2
3 years	1
4 years	2
6 years	2
8 years	1
9 years	1
10 years	1
13 years	1
17 years	1

SYMPTOMS

Of the various symptoms mentioned by these patients, two were constant and present in each case. These symptoms were frequency of urination and pain. The pain was generally described as severe in character, and it was of two kinds: pain that was present more or less constantly and pain that was present during, or aggravated by, micturition. In some instances the patients were unable definitely to localize the pain, simply stating that the pain was located in the bladder. Some were more specific and volunteered the information that the pain and soreness were located in the neck of the bladder. In one case the pain was so severe as to produce spasms of the bladder. In another case, in addition to the pain in the bladder, the patient complained of pain over the right hip, and in another case there was pain in the vagina. In one case the bladder pain radiated to the kidneys; in another, associated with the pain in the bladder, there was a constant pain over both kidneys, which may have been due to the pyelitis that was also present. The pain was often aggravated by the local treatment to which some of the patients had been subjected prior to coming under observation.

Apart from pain in the bladder and radiating pains, there was also present pain on urination. This pain was described in such terms as burning, smarting, cutting, tooth ache-like, and cramp-like, expressions which would lead one to suspect that the degree of pain was rather severe.

Frequency of urination was found to be present in each and every case, and was more or less constant, the patients never being completely free of this symptom although the degree varied. It would appear that with an apparent or temporary improvement in the local condition there was a diminution in the number of micturitions, both day and night. All these patients were obliged to arise at night, varying from once every hour to once every 20 or 30 minutes, so that they were often below normal as a result of loss of sleep, as well as from the effects of the continued painful urination. In several, the frequency seemed to bear some relationship to menstruation, since there was an increase of frequency just prior to or during the menstrual period.

Hæmaturia. The presence of gross blood in the urine was noted in 6 of the 14 cases. This varied in severity from a slight amount of bleeding, just enough to stain the linen, to the passage of bloody urine with clots. Sometimes the bloody urine was noted only after instrumentation of the bladder, such as the passage of catheters and after bladder lavage. If, during irrigation, the bladder is overdistended, bleeding is easily started. This can be demonstrated very convincingly, if, just prior to the close of the examination, a little more fluid is allowed to run into the bladder so as to cause overdistention.

Other urinary symptoms were not present as constantly as the previously described group. Urgency was mentioned in 6 cases; burning on urination in 6 cases; tenesmus in 3 cases; backache in 6 cases. Gastro-intestinal symptoms were rather insignificant. Nausea and vomiting, as well as rectal symptoms, were absent. Constipation was present in 6 of the 14 cases, and considering that all were women, with the exception of one, this is not of any moment. Chills and fever were present only once.

Roentgen-ray examinations of the urinary tract were made in each case. No evidence of calculi was found in the kidneys, ureters, or bladder. Wassermann reactions were negative in each case. Guinea-pigs were inoculated and were negative for tubercle bacilli in every case. Careful examinations of the teeth, tonsils, and sinuses were made for foci of infection with the following results:

Case 1. Tonsils slightly enlarged. Teeth in good condition.

Case 2. Tonsillectomy advised.

Case 3. Tonsillectomy advised. Also removal of two teeth.

Case 4. Tonsils absent. Urethral discharge and inflammation of Skene's glands.

Case 5. Asthma for 20 years. Teeth negative. Slight cloudiness in X-rays over right side. Possibly, antrum infection.

Case 6. No examination.

Case 7. X-rays of teeth negative.

Case 8. Pus expressed from tonsils. Tonsillectomy advised.

Case 9. Tonsils absent.

Case 10. No examination.

Case 11. No examination.

Case 12. No examination.

Case 13. Many infected teeth removed after coming under observation.

Case 14. Watery discharge from right antrum. Tonsils absent.

In 13 of the 14 cases accurate records of urine studies were available. (See Table I.

A review of the table shows only one patient who had a normal urine. Seven cases had some pus in the urine. The amount was variable. Leucocyte counts were made in these cases in order to have a more or less accurate record of the amount of pus present. The highest count was found in Case 1, in which 7,290 pus cells per cubic millimeter were found. The lowest count was 70 cells.

In 7 cases the ureters were catheterized. In Cases 2 and 14 pus was found on both sides. In Cases 5 and 9 counts are a bit high in urine obtained from the right kidney.

Cultures were made with the following results. In 5 cases sterile urines were found; in 3 cases one kidney only was sterile. In the remaining cases positive cultures showed both kidneys and bladder infected with bacillus coli (1 case); bladder and right kidney with bacillus coli (1 case); colon and staphylococcus (1 case); streptococcus and staphylococcus (1 case); staphylococcus in right kidney and bladder (1 case); staphylococcus only (1 case); diphtheroids in left kidney and bladder (1 case). The statement that the colon bacilli outgrow other organisms apparently does not hold in this group of cases. Red blood cells were found in the urine in 5 cases.

CYSTOSCOPY

The prominent feature in this group of cases is that the cystoscopic examination was painful and the bladder capacity very limited. Cystoscopically the ulcers varied in size from a pinpoint to 2 cubic millimeters in diameter. The area of ulceration was surrounded by a zone of hyperæmia which was sharply circumscribed, and by the bladder mucosa which appeared normal. The surface of the ulcer may be covered with mucopus. Areas of oedema around the areas of ulceration were not seen. Overdistention of the bladder was the cause of pain and of starting hæmorrhage, which was so profuse at times as to interfere with the cystoscopic examination.

The cystoscopic picture is variable, depending on the state of healing of the ulcer. This has led to the term "elusive ulcer," which term has been rather confusing.

In case the surface of the ulcer is healed, there is seen a definite area in which there is an increased vascularity. Most often, however, definite ulceration is seen. Many times it is necessary to carry out repeated cystoscopic examinations before making the final diagnosis. In several instances the lesion was at first confused with tuberculosis.

Location. In 9 cases the area of ulceration was seen in the apex of the bladder, that is, the dome of the bladder. In 3 cases, areas of ulceration were seen on the posterior wall only. In 2 cases the left lateral wall was the site of the ulceration and in one case the anterior wall was the seat of ulceration. In some of the cases there was more than one area of ulceration. In one case there were areas of ulceration near the right ureteral orifice in addition to ulcers in the apex.

Diagnosis. Once the condition was recognized, it was not difficult to diagnose in the subsequent cases. Because of the history of long-standing distress, the extreme pain in introducing the cystoscope, which in some cases necessitated the use of anæsthesia, the limited bladder capacity, and the presence of areas of ulceration in the bladder, my chief concern was in regard to the exclusion of tuberculosis. This was effected by diligent search for tubercle bacilli in stained specimens as well as by repeated guinea-pig inoculations.

TREATMENT

The concensus of opinion among urologists is that this is a surgical condition and that once the diagnosis is made, nothing short of an operation will suffice. Indeed, it is the last choice as far as our therapeutic agents are concerned, since the majority of these patients have had all sorts of local treatment, the only result of which seems to be an aggravation of symptoms.

Wide resection of the ulcer-bearing area is the only treatment that has been carried out in this series with the exception of two cases which were treated by fulguration. In one case fulguration had been instituted elsewhere, and although most authors condemn this form of treatment, yet the result in this case (perhaps temporary) was rather striking, as brief résumé of patient's history shows.

Mrs. M., age 38. Symptoms started 3 years ago with nocturia, burning on urination, urgency, and cloudy urine. Condition gradually became worse, and one year after onset of trouble patient was cystoscoped and a diagnosis of ulcers of the bladder made. Fulguration treatments were instituted, resulting in almost complete relief of symptoms. Her last treatment was 6 weeks before coming under our observation. She came in for fulguration because of a gradual return of symptoms. Three weeks after the last fulguration she was delighted with the result and voided only twice during the night before reporting at the office. A recent letter from her physician states that she is completely relieved of her symptoms.

RESULTS OF TREATMENT

CASES OPERATED UPON

Case 1. Mrs. P., age 28. Onset of symptoms 9 years ago. Left nephrectomy performed for renal tuberculosis, no improvement. Complained of frequency of urination, varying from every 3 minutes to 1 hour, and of pain in bladder; hæmaturia. Eighteen months after resection of ulcer, patient stated, her urinary condition was very satisfactory and it was almost impossible to believe that she could get along so nicely after having had so much trouble. She has been able to go for as long as 8 hours without voiding.

Case 2. Mrs. G., age 42. Trouble started 4 years previous to operation, with pain on urination, frequency every half hour, and nocturia from two to eight times; pyuria, hæmaturia; pain in back and pain in bladder during movements of the bowel. Twenty-five months after operation, patient is free of all urinary symptoms. Still has pain in the back due to pyelitis. Now voids four or five times in the day and once at night. A recent examination of the urine showed a faint trace of albumin, a few pus, and red blood, cells. Cultures showed bacillus coli and a cell count of 92.

Case 3. Mrs. T., age 32. Symptoms began 2 years ago with burning on urination, hæmaturia, and urgency. Later, pain in the bladder and frequency, every half hour in the day and seven to eight times at night. Eighteen months after operation patient says she feels she is entirely cured of her urinary trouble. She now voids every 2 or 3 hours in the day and occasionally gets up once at night. No burning or hæmaturia.

Case 4. Miss K. D., age 32. Symptoms present 1 year and complained of pain in bladder, frequency, urgency, and loss of weight. Seventeen months after operation patient states she is enjoying excellent health. No urinary symptoms, but quite frequently she has a feeling of soreness in left side of bladder. Otherwise thinks she is 100 per cent cured.

Case 5. Miss D., age 46. Before operation complained of painful urination, frequency, and nocturia. Onset 4 years ago. Was operated on and a growth was removed from the bladder. Hæmaturia was relieved by operation but other symptoms persisted. Fourteen months after operation, patient stated she felt well until lately; at present has pain in bladder and soreness, especially on walking.

Case 7. Tony M., age 24. Symptoms started 11 months ago with painless hæmaturia. Two weeks later slight burning on urination and pain in perineum. Frequency many times a day and also nocturia present. Eight months after operation, cystoscopic examination showed the bl dder absolutely negative; bladder capacity 15 ounces. No pain, frequency, or nocturia at present.

Case 8. Mrs. K., age 35. Onset of rouble 13 years ago, starting with frequency of urination, burning, pyuria, and fever. Later, backache, pain in bladder and in vagina. Five years after onset of trouble, appendix and left ovary removed without relief of symptoms. Last October patient was operated upon for elusive ulcer; 5 months later stated she was feeling quite well but still has trouble holding the urine. Can hold the urine for

about 2 hours, but after that has pain in the bladder. This condition is present day and night. Before operation she voided every hour day and night.

Case 5. Mrs. C., age 51. Six years ago patient had an attack of frequency and burning on urination following a cold. Every winter since that time, patient has had similar attacks, lasting a week or more. She complained of retention, marked urgency, hæmaturia occasionally, backache, and pain in bladder. Nine weeks after operation, patient states, her frequency is much improved, voiding every 2 hours in the day and about [illegible] at night. No blood in the urine since the operation, and patient can retain the urine for one hour after having a desire to void. She has also gained in weight. Still has an occasional slight backache.

CASES NOT RELATED HERE

Case 6. Mrs. C., age 40. Symptoms started 17 years ago after birth of her second child, at which time she had pain in bladder, pain in right kidney region, pain in right inguinal region, and frequency. Four operations were performed for this trouble: suspension of the uterus, perineorrhaphy, hysterectomy, and removal of urethral caruncle. She has had no treatment of any kind since coming under observation. At present her condition has greatly improved and she has suffered less than at any time in the past 10 years.

Case 7. Mrs. C., age 50. Stricture at neck of bladder started about 2 years ago; also had frequency of urination and nocturia. Not treated, present condition not known.

Case 11. Mrs. M. Treated by fulguration.

Case 12. Miss A., age 36. Symptoms began 6 years ago with frequency, pain in bladder, pain and burning in epigastrium; loss of weight. She was operated upon 5 years ago, ventrofixation. Symptoms not relieved, present condition not known.

Case 13. Mrs. K., age 61. Urinary trouble started 8 years ago with frequency, smarting pain on urination, and tenesmus. Many local treatments; condition at first temporarily relieved and later made worse by bladder irrigations. No treatments for 2 years, and, patient states, at present she has practically no pain and the urine is usually clear, only occasionally cloudy. Every now and then she passes pieces of tissue in the urine. She has not taken any medicine or sitz baths, but occasionally when pain threatens to return uses vaginal douche.

Case 14. Mrs. S., age 39. Symptoms have been present for [illegible] years. Started with gradual onset of frequency, burning, and pain in bladder. No treatment until [illegible] years ago when patient consulted a physician who told her she had inflammation of the bladder and gave her internal medicine. She has had bladder irrigations which relieved symptoms for several months; after stopping irrigations symptoms would recur. Symptoms have never been very acute. In last month she has had a dull pain over the right hip when lying down. Backache has been present continuously for 1 month.

[illegible] 1921. Bladder capacity about [illegible] ounces. Near the internal urethral orifice was seen a very vascular area about the size of a [illegible] in the [illegible] wall. Other areas were seen in the [illegible] but were not injected. [illegible] During cystoscopy patient developed severe bladder spasm and it was then possible to demonstrate clearly the [illegible].

[illegible] bladder. No real ulcerations seen. Ureteral openings were found and catheterized without difficulty or obstruction.

[illegible] In the apex of the bladder [illegible] very prominent, well defined, and apparently the site of elusive ulcers covered with [illegible].

Two sets of guinea-pigs were injected with the urine from the right and left kidneys and bladder on September [illegible] and January 30, 1922. Both sets were negative for evidences of tuberculosis. Urine was centrifuged many times and careful examinations of the sediment found no positive evidences of tuberculosis.

Patient was fulgurated on April 6, 1922, and on April 12 she stated she was more comfortable than she had been for a year. She has been voiding normally in the day and twice at night. On May 1 she had a recurrence of her symptoms but not as marked as formerly.

SUMMARY

Of the 8 cases operated upon, one is having a relapse and another has pus and staphylococci in the urine. The remaining cases consider themselves well; that is, they are free of symptoms.

Two cases were treated by fulguration with an immediate relief of symptoms. Time only will tell whether this will be permanent.

Of the remaining 4 cases, 2 are no longer under observation and the other 2 have shown an improvement in their condition, this without any treatment. However, these 2 cases are not entirely free of symptoms.

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THE RESULTS OF OPERATIONS FOR CANCER OF THE LIP AT THE MASSACHUSETTS GENERAL HOSPITAL FROM 1909 TO 1919[1]

By CHANNING C. SIMMONS, M.D., F.A.C.S., and ERNEST M. DALAND, M.D., Boston

THE following paper is based on the cases of cancer of the lip admitted to the Massachusetts General Hospital during the ten-year period from January 1, 1909, to January 1, 1919. This period was chosen in order that three years should have elapsed since operation in every case, and no patient who is not known to have been free from the disease for at least that length of time after operation has been considered as a cure.

There were 172 primary cases admitted to the hospital during this period together with 15 cases of cancer of the lip recurrent from previous operation. The cases were operated upon by 10 members of the surgical staff to whom the writers wish to acknowledge their appreciation for permission to report them. Thanks are also due to Dr. H. F. Hartwell, surgical pathologist, for assistance in reviewing the pathological specimens.

In making this analysis we have reviewed every case admitted to the wards during the ten-year period and in obtaining the figures all cases have been included in which an attempt was made for a surgical cure. In many cases operated upon the disease was far advanced, and it is partly for this reason that the percentage of cures shown is less than that in the series reported by Broders (1) and Bloodgood (2). No case has been accepted as a cure unless a pathological examination of the tissues removed at operation was made, and patients dying within the arbitrary three-year limit without recurrence have been excluded as inconclusive.

The form adopted in reporting this series is one that was first used in a paper on the results of operations on cancer of the buccal mucosa (3), as at that time it was found impossible to compare the statistics with those of other writers. The same form has since been used in reporting two other series of cases (4 5) and has proved very satisfactory. It was possible, in fact, to compare accurately the results of a personal series of cases of cancer of the breast with those of a previous series representing the experience at the Massachusetts General Hospital (6).

The accepted operation for cancer of the lip is excision of the growth, with or without a plastic closure of the defect, and the removal of the fat and glands in the submental and submaxillary space and to the bifurcation of the carotid, from one or both sides of the neck depending on the situation and size of tumor. We shall speak of this hereafter as the radical operation. We have used the term "palliative" operation to describe cases in which the growth alone was excised and no dissection of the neck done. We consider this operation justifiable only in the very early cases which are clinically precancerous, or where the radical operation is contra-indicated on account of the age or physical condition of the patient.

The total number of cases available for study was 187, divided as follows:

Recurrent from previous operation	15
Inoperable or operation not advised	5
Refused operation	4
Radical operations	122
"Palliative" operations	41
Total cases	187

No attempt has been made to determine the end-results in the recurrent cases or those in which no operation was performed. Of the remaining 163 cases, the end-result is known in 138 instances, or 84.7 per cent of the cases.

ETIOLOGY

No new facts in regard to the etiology of cancer of the lip have been brought out by this study. The disease was confined almost entirely to men, there being 170 males and 2 females in the series. The growth occurred on the upper lip 4 times and on the lower 168. People of all ages were affected, the extremes

[1] From the Cancer Commission of Harvard University. Read, by invitation, at the meeting of the American Surgical Association at Washington, May 1, 1922.

being 24 and 93 years of age, although it was more common between 45 and 70. The average age was 54.75 years.

AGES OF PATIENTS

20 to 25 years	[illegible]	[illegible]	[illegible]
25 to 30 years	1	[illegible]	[illegible]
30 to 35 years	[illegible]	70 to 75 years.....	15
35 to 40 years	[illegible]	[illegible]	[illegible]
40 to 45 years	[illegible]	[illegible]	[illegible]
45 to 50 years	[illegible]	[illegible]	[illegible]
50 to 55 years	[illegible]	[illegible]	[illegible]
55 to 60 years	[illegible]	[illegible]	[illegible]

Persistent chapped lips, keratosis, seborrhœa, or leucoplakia of the lips preceded by some time the appearance of the growth in a large group of cases. Sixty-two patients gave a history of some form of irritation of the skin of the lips present for months or years before the appearance of the cancer. Patients with this history are particularly liable to have what we have termed re-occurrence, of the disease, in distinction to recurrence, after the removal of a primary cancer. By re-occurrence we mean the formation of a second cancer of the lip after the removal of a primary growth, the second cancer being on a portion of the lip remote from the scar of the operation. Eight cases in this series are cases of re-occurrence and all presented a well healed scar at one point on the lip and a cancer at another point. Two other cases in the series developed a re-occurrence after removal of the primary growth in the hospital. These were excised and both patients are living and well more than three years after the second operation.

One hundred patients smoked tobacco including 6 who also chewed. Pipe smokers predominated. Nine patients did not use tobacco in any form, while the records are inconclusive in 63. One patient, who did not use tobacco, was a shoe worker and in the habit of keeping nails in his mouth while at work. Broders has shown that the percentage of tobacco users in patients with cancer of the lip is approximately the same as that in a series of 500 patients without cancer of the lip but that the percentage of pipe smokers is much greater.

Wassermann examinations were made at the hospital as a routine procedure during the latter part of the decade studied but not during the first part. There were examinations on only 56 patients. The reaction was positive in 12 and negative in 44 cases. It is interesting to note that in [illegible] a primary lesion developed at the site of the scar of excision of the cancer of the lip in one of which the nodule was excised under the impression it was a recurrence. In a third case a cancer developed in the scar of a chancre of the lip acquired two years previously.

[illegible]

Specimens from 103 of the 131 patients in whom the end-result is known, were available for re-examination. The tumors varied from the early papillary type of cancer, a condition which might almost be termed precancerous, to carcinoma of the squamous-cell type but with little differentiation of the cells. An attempt was made to grade these specimens into three groups according to their malignancy, the criterion being the amount of differentiation of the cells and the number of mitotic figures. In Group 1 were placed those tumors in which the cells had a marked tendency to differentiate, as shown by the formation of epithelial pearls, and in which mitotic figures were comparatively infrequent. In Group 2 were placed those cases in which there was less tendency to differentiate and evidence of more rapid growth. In Group 3 were placed cases in which the cells infiltrated the tissues and showed little or no tendency to differentiate. This grading was done without knowledge of the clinical side of the case and the results compared later. They are as follows:

RESULTS—PATHOLOGICAL CLASSIFICATION

[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
Group 3..	[illegible]	[illegible]	[illegible]

It would seem, therefore, that other things being equal, such as the extent of the growth and its duration, the amount of differentiation of the cell has a distinct bearing on the prognosis of the disease.

The presence of palpable glands did not necessarily mean that metastases had oc-

cured as in many cases in which the presence of glands was noted in the history pathological examination failed to show cancer. It is impossible, however, to say that metastases have not occurred unless serial sections are made of all tissue removed. Metastatic cancer was found in the glands in 24 of the 110 cases in which neck dissection was done and in which we have a report on the glands. Absence of clinically enlarged glands, on the other hand, does not rule out metastases as, in 24 cases in which it was noted in the record that there were no palpable glands, cancer was demonstrated in the tissue removed from the neck in 6, or 25 per cent.

The presence of demonstrable metastatic cancer in the glands was a grave prognostic sign. In the 19 cases in which metastases were found and in which the end-result is known, 5, or 27.7 per cent, are living and well, while in the 72 traced cases in which no cancer was found in the glands, 63, or 86.6 per cent, were cured.

SYMPTOMS

The symptoms consisted of a painless ulcer or tumor of the lip preceded in 62 cases by a history of chapped lips, keratosis or leucoplakia. The first symptom was described as a "sore" or "cold sore" in 83 cases, a "scab" in 19, and a "wart" or "tumor" in 38. In the remaining cases it was variously described as a pimple, crack, blister, cut, etc. In a few cases it was the presence of enlarged metastatic glands in the neck that first led the patient to consult a physician.

The tumor was of comparatively slow growth, the average duration from the onset of symptoms to the admission to the hospital being 11.9 months (data on 156 cases). The delay on the part of the patient from the appearance of the disease to the first consultation with a physician was 4.35 months (data on 123 cases), and the delay from the first consultation until operation was advised averaged 1 month (data on 125 cases).

Palpable glands were noted as being present in the submental or submaxillary spaces or elsewhere in the neck in 119 of the cases but on subsequent pathological examination many of these proved to be inflammatory. The presence of glands had little relation to the size or duration of the tumor except in the obviously far advanced cases. This is not surprising considering the septic condition of the mouth in many of the patients in addition to the presence of an ulcerated or partly necrotic tumor of the lip. The teeth were mentioned as being in poor condition, or carious, in 97 cases.

The situation of the tumor on the lip was as follows:

SITUATION OF GROWTH

	Cases
Right side	51
Left side	57
Center	25
All lip	14
At angle of lips	6
Upper lip	4
Not stated	15

The growth was described in the records under the following headings:

TYPE OF GROWTH

	Cases
"Fungating"	21
Ulcerative	84
Tumor	34
Warty	14
Miscellaneous	19

OPERATION

The radical operation was performed on 122 cases with the removal of the glands from one side of the neck in 73 and from both sides in 49. The operation was performed essentially as follows: A curved incision was made beneath the jaw from the chin to about one inch below and behind the angle. This was carried through the skin and platysma and the flaps reflected. The contents of the submental space was removed and the digastric muscle developed, the facial artery being tied at its entrance into the submaxillary gland. The fat and glands beneath the angle of the jaw and down to the bifurcation of the carotid artery were dissected free and the mass, including the submaxillary gland, removed *en bloc*. The hypoglossal and lingual nerves beneath the submaxillary gland should be recognized and avoided. The branch of the facial nerve supplying the muscles at the corner of the mouth runs between the platysma and the skin a short distance below the angle of the jaw and should not be injured by the incision. It was apparently divided, how-

ever, in a large number of cases with consequent drooping of the corner of the mouth. The wounds were closed in layers, with catgut sutures to the platysma, and drained with a small cigarette wick. If the wounds were not drained, serum and saliva from the intermuscular portion of the submaxillary gland not removed or from the wounded parotid gland, usually collected, necessitating secondary drainage. After closure of the wound in the neck the growth on the lip was excised by a V-shaped incision and the wound closed by sutures to the mucous membrane and skin. If it was necessary to remove a large portion of the lower lip, some form of plastic operation was done to close the defect. Theoretically a bloc dissection, removing the growth on the lip with the glands from the neck in one piece, is the operation of choice, but practically, if the wound in the neck connects with the oral cavity, extensive sepsis usually supervenes.

When the glands were removed from both sides of the neck, the incision was made beneath the jaw from below the angle on one side to a similar position on the other. In five cases a more radical neck dissection was done than that described above, with the removal of the internal jugular vein, the sternomastoid muscle, and the glands to the clavicle.

Palliative operations. What has been termed in this paper the palliative operation, that is, the removal of the growth from the lip without dissection of the glands of the neck, was performed 41 times. In 10 cases the growth was small, papillary in type, and might almost be termed precancerous. In 3 it was extensive and the operation was done to remove a sloughing tumor. In many of the remaining 28 cases, the age of the patient or his physical condition was a contra-indication to radical operation, but there was a small group in which, from the records, the reason for not removing the glands from the neck was not clear.

Operative mortality. There were three postoperative deaths in the series of 122 radical operations, an operative mortality of 2.5 per cent. There was one death from erysipelas and auricular fibrillation on the seventeenth day, one from sepsis and pneumonia on the tenth day, and one from probable pulmonary embolus on the second day. All of these patients were what might be termed poor surgical risks. One of the deaths occurred after the removal of the glands from one side of the neck, and from both sides. There was no operative mortality following excision of the growth only.

Postoperative complications. In addition to the three postoperative deaths there were several cases of postoperative complications. All, with one exception, were due to some form of infection. There were 10 cases of serious sepsis, several of minor sepsis, and one case of phlebitis. One patient developed postoperative pneumonia and there were three cases of severe bronchitis. There was one case of severe postoperative hæmorrhage, probably due to the slipping of the ligature on the facial artery, which necessitated packing of the wound. All of these patients eventually made satisfactory recoveries.

Plastic operations. In 10 cases in which the growth was extensive it was found impossible to close the defect in the lip in the usual manner without tension or without making the oral opening too small. Some form of plastic operation was performed on these cases to remedy the defect. The cases have been grouped separately as the extent of the local lesion had a distinct relation to the prognosis. Thus of the 14 cases in this group that have been traced, 10 have died of a recurrence of the disease, while 4 (28.3 per cent) are living and well.

SECONDARY OPERATIONS.

Secondary operations for local recurrence of the disease were performed twice and both of these patients are well three or more years after the second operation. A cancer re-occurrence formed at another point on the lip and was removed in two other cases. Both patients are also well three or more years after the second operation.

In seven cases in which the neck had previously been dissected, a second extensive dissection was performed for recurrence. All of these patients are dead; two as a result of the operation, and five of the disease.

RESULTS

There were 122 cases in which an attempt at cure by a radical operation was made. In 73 the local growth was excised and the glands dissected from one side of the neck, and in 49 the glands were removed from both sides of the neck. Dissection of both sides of the neck usually implied that the growth was extensive or situated in the center of the lip.

The results are about what might be expected in a series of consecutive cases in a large general hospital. Of the 122 cases the end-result is known in 103, but in 5 cases the data are inconclusive, the patients having died of some other disease within the three-year limit without recurrence. Of the remaining 98 cases, 68 are living and well without evidence of the disease, or have died of other cause more than three years after operation, while 30 are dead; 27 from a recurrence of the disease and 3 as a result of the operation. This gives 68.1 per cent cures following the radical operation.

RADICAL OPERATIONS

Total cases	122
End-results known	103
Inconclusive	5
Postoperative deaths	3
Died of recurrence	27
Living without disease 3 years or more	68
Percentage 3-year cures	68.1

If these cases are separated into two groups, Group 1 being those cases in which the glands from one side of the neck were removed, and Group 2 being those in which the glands were removed from both sides of the neck, it is seen that the percentage of cures in Group 1 is larger than in Group 2. This implies only that the extent of the local disease bore a direct relation to the prognosis, as the double dissection was usually done in the more advanced cases. The relation of the size of the growth on the lip to the prognosis is also shown by the small percentage of cures in the group of cases requiring a plastic operation to close the defect after excision of the growth. Thus in 14 traced cases in which the wound of the lip could be closed only by employing some form of plastic operation, but 4 (28.3 per cent) are living and well.

RADICAL OPERATIONS

	Dissection glands one side of neck	Dissection glands both sides of neck
Total operations	73	49
End-results known	64	39
Inconclusive	3	2
Postoperative deaths	1	2
Died of recurrence	13	14
Three-year cures	47	21
	(77 per cent)	(54 per cent)

The percentage of cures in the cases in which metastatic cancer was demonstrated in the glands removed was much smaller than in the cases in which no metastases were found. In 19 traced cases in which the glands were involved by the disease, 5 are well (27.7 per cent), while in the 72 conclusive traced cases in which no cancer was found in the glands, 63 are well (86.6 per cent). The radical operation would seem to be justified if 27.7 per cent of the cases with known metastases are cured.

RESULTS—METASTATIC GLANDS

	Cancer in glands	No cancer in glands
Total cases	24	92
Untraced	4	9
End-results known	20	79
Inconclusive	0	4
Postoperative deaths	1	2
Died of recurrence	14	9
Three-year cures	5	63
	(27.7 per cent)	(86.6 per cent)

The site of recurrence could not be determined in many of the cases. We have no evidence of general metastasis in any case but the data are not conclusive as the facts in regard to patients dying of recurrence were usually obtained either from letters from friends or relatives, or from the death certificates on file at the Bureau of Vital Statistics at the State House. In the only patient dying of recurrence on whom an autopsy was performed, there was local recurrence only. As well as could be determined the site of recurrence was as follows:

SITE OF RECURRENCE—RADICAL OPERATION

In neck only	13
Neck and local	5
Local only	4
Undertermined	5

In one case in which the glands were removed from one side of the neck the first evidence of

recurrence appeared in the glands of the opposite side.

Palliative operations (local excision only). There were 41 cases in this group operated upon without mortality. In ten instances the tumor was small and although pathologically cancer, it might well be considered clinically as precancerous. Eight of these cases have been followed and all were cured. Three cases were obviously palliative operations as the growth was large and a plastic operation was necessary to close the wound. Two of these cases have since died with both local and glandular recurrence and the third has not been traced. Of the remaining 28 cases, five are inconclusive or have not been traced and 11 have died of recurrence. Twelve (60.6 per cent) are living or have died of disease other than cancer more than three years from the date of operation. In most of these cases the radical operation was contraindicated on account of the physical condition or age of the patient.

Taking the "palliative" operations as a group, the figures are as follows:

RESULTS—LOCAL EXCISION ONLY

Total cases	41
End results known	[illegible]
Inconclusive	[illegible]
Died of recurrence	11
Three year cures	[illegible] per cent

Of the 13 cases dying of a return of the disease, the site of the recurrence is known in 9. In 4 cases the recurrence was in the glands of the neck only, in 4 it was both glandular and local, and in 1 it was local only. If 27 per cent of the cases in which metastatic cancer is demonstrable in the glands removed from the neck are cured by a radical operation, it is presumable that a certain number of cases in this group would have been cured if the more extensive operation had been performed.

The average length of life of all cases dying of recurrence from the date of operation was approximately two years (23.3 months). In cases in which the glands removed at operation showed cancer, the length of life was slightly shorter than the average (21.7 months). With one exception in all cases dying of the disease the recurrence or death occurred within the [illegible]. One case died of glandular recurrence 7 years after the primary operation. The history of this case is as follows:

[illegible] done, but the patient died of the disease 8 months later.

CANCER OF THE LIP—RESULTS

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Mortality, "palliative" operations	0
[illegible]	
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
"Palliative" operations	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Number 3-year cures, all operations	[illegible]
Number 3-year cures, radical operations (68.1 per cent)	[illegible]
Number 3-year cures, "palliative" operations (60.6 per cent)	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Cures, radical operations, glands cancerous	[illegible]
Cures, radical operations, glands not cancerous	[illegible]
[illegible]	[illegible]
Cures, radical operations, both sides neck dissected	56.8
[illegible] when plastic closure necessary	[illegible]

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RESUSCITATION, INTRACARDIAC INJECTIONS

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THIS paper is based upon observations made during three and one-half years of active surgical service in the British Army in Belgium, France, and Great Britain during which time the author performed upward of 5,000 operations under chloroform, ether or spinal anæsthesia, and upon observations made in the clinics of his chief, Professor A. J. Ochsner, at the Augustana and at St. Mary's of Nazareth Hospitals, Chicago.

It was very noticeable during the Great War that patients who had suffered from severe hæmorrhage did not tolerate grave operations under spinal anæsthesia, several deaths occurring in this class of patients. However, it is doubtful whether these seriously wounded cases could have survived under any other anæsthetic unless it had been nitrous oxide and oxygen.

This same class of patients, after transfusion with blood in sufficient volume (700 to 1200 cubic centimeters), could be given spinal anæsthesia with entire safety. This fact would seem to argue that, when collapse occurs under spinal anæsthesia, it is due to the lowering of an already low blood pressure by the engorgement of the arteries (as well as the veins) of the anæsthetized part of the body, due to muscular relaxation combined with a general relaxation of the entire body, thus removing the muscular tone so important in insuring the venous return from the limbs.

Bearing in mind these considerations as well as the work of George W. Crile upon "Anæmia and Resuscitation," the author employed adrenalin resuscitation in five cases with immediate success in each case and with permanent success in two cases after failures by ordinary methods.

The first case was seen at No. 17 Casualty Clearing Station near Ypres in Belgium in 1917. During the terrible rush of work following the British onslaught on Paschendale Ridge, it was sometimes necessary for a surgeon to operate so fast that the anæsthetist had to keep three patients under chloroform anæsthesia simultaneously; inducing anæsthesia for one, maintaining surgical anæsthesia for the second, and allowing the third to recover while orderly applied bandage or splint.

Case 1. The patient under discussion, a young enemy soldier, had been anæsthetized with chloroform and resection of the lower lobe of the lung was being done for gangrene. The left chest was open and a suture-ligature had been placed about the lung proximal to the gangrenous portion and was tied. While resecting the lobe it was noticed that the heart became irregular and stopped shortly. I made direct manual massage, compressing the ventricles and allowing them to expand until the heart beat again rhythmically but without full systole. It quickly ceased to beat again when direct massage was of no avail except to elicit an infrequent and incomplete systole. I then stimulated the myocardium with the point of a scalpel, a few contractions following each prick but soon nothing but fibrillary twitching resulted. Respiration had ceased and artificial respiration was being done, my fist closing the parietal wound in the chest. Artificial respiration and cardiac massage was continued for perhaps 15 minutes after final cardiac failure. Oxygen gas was administered to no avail.

I then procured a large 20 cubic centimeter Luer syringe and injected directly into the left ventricular cavity about 10 cubic centimeters of adrenalin 1:1000. I gave the heart a squeeze and it began to beat, firmly and with far greater vigor than I had yet noted. Artificial respiration was recommenced and continued for about 20 minutes during which time no respiratory effort was made. A tracheotomy was then made and a catheter introduced into the right bronchus. A tank of oxygen was attached to the catheter and sufficient pressure allowed to inflate moderately the right lung. The respiratory exchange was sufficient to keep the patient's color a healthy pink—better than it had been before his operation as he was deeply cyanosed, due to the pneumothorax and pulmonary gangrene. After about 25 minutes from the intraventricular injection of adrenalin, the heart again began to fail by dropped beats and failure to make complete systole. Another injection of about 10 cubic centimeters of adrenalin was given intraventricularly. The result was a return to full systole and regularity with increased frequency in rate. During all this time (estimated at about 40 minutes) *there had been no respiratory movement.* After about 40 or 45 minutes the patient began to breathe, making very feeble inspiratory movements

at long intervals. The depth of respiration gradually increased and the rate improved until about 50 minutes after the initial cardiac and respiratory failure he began to breathe of his own automaticity. The catheter was removed from the trachea and bronchus but oxygen was still supplied. The patient continued to breathe and the heart to beat for about 25 minutes more when the supply of oxygen failed. He then became cyanosed and the heart beat weakened somewhat. At this time a prisoner of war was found who volunteered to be donor for the transfusion of blood. Six hundred cubic centimeters of blood was transfused slowly into the median basilic vein of the patient and within a minute afterward the heart (which I held in my hand) dilated, fibrillated and ceased to beat.

It is interesting to note the fact that respiratory impulse did not return for a long time and that, although ample time elapsed and respiratory exchange was sufficient for the disappearance of chloroform narcosis (which was never profound) consciousness never returned. This fact bears out G. W. Crile's statement that ischæmia of the higher cerebral centers in dogs which persists more than 10 minutes seldom is followed by recovery of function. Therefore, even though it had been possible to continue the resuscitation of this patient it is practically certain that no psychical function ever would have returned.

To recapitulate: 1. Cardiac and respiratory failure due to chloroform and shock;

2. *Direct* cardiac massage and stimulation combined with artificial respiration failed to resuscitate;

3. Intraventricular adrenalin (after at least 15 minutes of complete cardiac failure) resuscitated cardiac function;

4. Respiration returned after 45 minutes.

Case 2. Patient undergoing amputation in the hands of one of my colleagues. When first seen spinal anæsthesia had been induced, the injection having been made in the usual manner 8 minutes before. Anæsthesia had resulted, the amputation had begun and progressed to the point of skin dissection, when the patient showed signs of collapse.

When called to see the case, the respirations had ceased but the heart was beating slowly, each beat following its predecessor more slowly. The force of the beats was good, the contractions of the heart apparently being efficient and forceful, the intervals being progressively lengthened. No pulse was palpable at the wrist. The eyeballs were rolled upward and to all appearances the patient was moribund. He was observed for perhaps 30 seconds, the amputation meanwhile progressing.

Fig. 1. Back view of [illegible] showing [illegible] before [illegible]

Artificial respiration was done, the heart rate continuing to decrease as was noted by palpation of the *femoral* artery at Poupart's ligament.

The amputation was completed but abandoned without ligature of the vessels or suture of the skin flaps since the case seemed hopeless. During the operation intravenous infusion of normal saline solution had been done and the cannula was in place in the right basilic vein. The heart gradually ceased to beat, during which time no respiratory impulse occurred. During a period estimated at between 5 and 8 minutes following the [illegible] or palpable heart beat, attempts to resuscitate the man were made by artificial respiration and thoracic and epigastric massage without avail. At the end of this time I injected 20 cubic centimeters of adrenalin hydrochloride into the rubber tubing of the infusion apparatus near the cannula and the adrenalin solution was washed in to the [illegible] by a flow of saline solution. Vigorous, heavy, epigastric massage was done.

The heart at once began to beat, respiration shortly began, and before one had time to realize the fact, the vital mechanism was once more in action. So vigorous was the response that alarming hemorrhage occurred from the [illegible] artery; the tourniquet not having been removed. There had been no hæmorrhage during the operation, thus showing that the adrenalin injection had raised the blood pressure considerably above what it had been before apparent death. The vessels were ligated and the patient returned to the ward where he made a perfect immediate recovery but died three days later of sepsis.

Case 3 was that of a young soldier of nineteen years who had suffered a shattering wound of his knee joint, which had to be amputated by reason of secondary hæmorrhage and sepsis combined.

The hæmorrhage was from the popliteal artery but was not severe in itself since the nurse on duty had applied a tourniquet at its inception. Stovaine was given intrathecally in the usual way. The operation was begun about 6 minutes later. Collapse occurred while the skin incision was being made. The patient complained of nausea, the face became pallid, the patient vomited and became perturbed, the respiration quickly failed, the eyeballs rolled upward, and the heart rate steadily became slower until it ceased. Its force was maintained until cessation occurred as in Case 2. Meanwhile, artificial respiration was done, traction was made on the tongue and the usual procedures during such times were carried out. After an interval of perhaps 4 to 8 minutes a 10 cubic centimeter syringe was obtained, and adrenalin hydrochloride 1:1000 was pumped into the basilic vein as much as 10 cubic centimeters being injected into the vein.

The adrenalin solution was washed in by saline solution and vigorous massage of the heart was done from the exterior. Pulsation began and at once became vigorous. Respiration and consciousness returned, and the amputation was carried to completion under the original anæsthetic. Apparently blood pressure was very high for about 2 hours.

The stump healed without incident and the patient was evacuated to England after 3 weeks, in good condition and is believed to be alive today.

Case 4. A case of suspended animation, due in this instance to chloroform poisoning, was that of a soldier of about 35 years, who was to be operated on for the removal of a small sequestrum from the neck of the humerus. The sequestrum was embedded in an involcrum at the site of fracture, a sinus having persisted for about a year. The patient was in every other respect in normal health. A chloroform anæsthetic was administered in the anæsthetizing room. On examination when brought into the operating room I discovered that his face was livid and that breathing had ceased. The head of the table was immediately lowered, artificial respiration was done, and we satisfied ourselves that there was no obstruction in his breathing. It was at least 5 minutes before a needle and syringe were brought, when two doses of 5 cubic centimeters of adrenalin (1:1000) were injected directly into the heart by puncture in the fourth intercostal space about an inch from the midline close to the sternal margin, thus avoiding the internal mammary artery. An ordinary lumbar puncture needle was used. There was immediate response, the heart beat at once and respiration followed very shortly. The anæsthetic remained deep enough for the operation to be performed without further administration of chloroform and the patient was returned to his ward 5 minutes later. There was some lack of mentality and confusion for the remainder of the day, but the patient did not complain of any abnormal symptom. At 1 a.m. the following morning the patient awoke, complaining of severe pain in the cardiac region; he was very restless and had some dyspnœa and there was irregularity of the pulse. Oxygen inhalations were administered, after which the patient slept for the remainder of the night, the attack having lasted for about 20 minutes. At 8 a.m. he recited his symptoms to me, still complaining of some pain in the precordial region. There was at that time no irregularity in the pulse. The subsequent day and night were without event, but the next day there was again a slight attack of anginal distress with slight irregularity of the pulse but without dyspnœa or fainting. From this time onward the patient made an uneventful recovery, and when seen 6 months later, was in normal health and doing manual labor, his wound having healed by primary union. He had never been told of his extraordinary experience, so that the attacks could not have been the result of hysteria but must have been due to some irregularity of the heart as a reaction after its unusual treatment. Neither of these patients who survived showed any abnormality which could be attributed to their 6 or 7 minutes of absolute cardiac failure.

Case 5 was a patient of my chief, Professor A. J. Ochsner. A man of 72 years was given spinal anæsthesia for the removal of the prostate gland. Cardiac and respiratory failure occurred after about 20 minutes. No heart beat was palpable, no pulse could be felt, no heart sound could be heard. Artificial respiration was done combined with extrathoracic cardiac massage for a period of about 15 or 20 minutes. During this time I had made several attempts to puncture the heart, but was not able to aspirate blood, which one does to prove that the heart cavity has been reached before making the injection. I then discovered that the spinal needle which had been used was plugged. Procuring a new needle the intracardiac injection of about 5 cubic centimeters of adrenalin was made and epigastric massage was done. The heart beat faintly at first but stronger and stronger until the radial pulse became full, hard, and regular. Artificial respiration was continued and after a while a few respiratory efforts were made. However, the heart gradually failed again after perhaps 25 minutes and nothing further was done. It is possible that had the intracardiac injection been made within the first 5 minutes, rather than after 20 minutes of complete cardiac failure, the patient might have recovered.

It would seem that the dosage of adrenalin, as used in the first cases, was rather large, and it might be that smaller doses would accomplish the same results, but one can never be sure that a small dose will reach the heart and this appears to be essential to the success of the treatment.

In the fourth case, where the adrenalin was

administered directly into the heart, 10 cubic centimeters seems to have been sufficient. In direct administration, however, there is always a possibility that the adrenalin will not reach the heart itself but will remain in the heart muscle. Also it generally requires a longer period of time to procure the long spinal needle necessary for intracardiac injection and the adrenalin cannot be washed into the circulatory system with a saline infusion as is possible if it is injected into the vein.

On the other hand, when the vein is not already exposed for infusion and when the blood pressure is very low or when no pressure exists, it is often difficult to enter the vein; and where speed is essential, it is quicker to inject directly into the heart. I do not know whether massage is essential to the instigation of the heart beat, since it was done at once in all cases without waiting to see if adrenalin alone were sufficient.

The mode of action in this treatment is presumably the same as adrenalin exhibits ordinarily. On reaching the heart auricle or ventricle, a forcible contraction occurs, emptying the auricular content into the ventricle, which then contracts (by the adrenalin action), filling the coronary arteries and expelling the ventricular contents into the aorta where the adrenalin again acts, and thus arterial tension is developed. It may be, too, that the first auricular contraction regurgitates adrenalized blood into the great veins, contracting them and thus filling the auricle in its diastole.

The cycle having been thus established, each subsequent contraction pushes the adrenalized blood further into the arterial system, increasing tension as it progresses and soon reviving the cerebral circulation and the respiratory center. One should make the injection as quickly as possible so as to revive the cerebral circulation since after an ischæmia of more than 8 to 10 minutes the higher centers may be permanently destroyed.

Adrenalin (1:1000), a sterile spinal puncture needle, and a large glass syringe would be valuable additions to every operating room

Note.—Since writing the above [illegible] have appeared dealing with the subject, all of which concur in the general principles involved

Walter Greuel (1) recommends the intracardiac inj[illegible] and reports 4 cases and states that [illegible]

[illegible] conjunction with i[illegible]

[illegible] death cannot be removed quickly and sets a time limit of [illegible] ent death.

[illegible] minute anatomy of the heart.

[illegible] of adrenalin [illegible] trophanthin (0.2-0.5 [illegible] adrenalin the sovereign agent.

All of the reports call attention to the [illegible] that a long needle must be employed. That heart blood should be aspirated to prove entrance into the heart cavity, that speed is very important, and that the massage of the heart should be made; in which we concur.

Several authors describe relatively minute dangers and discuss the nodes and bundles of the heart which we consider purely academic in importance and secondary to the all-important act of speedily injecting adrenalin into the heart cavity, let it be auricle or ventricle. Probably the left side of the heart is the best site since the pulmonary circulation does not then receive the adrenalinized blood directly.

It seems that the dose should be sufficient to insure the entrance of adrenalin into the heart cavity; that 1 cubic centimeter may be sufficient as recommended by Kneier or even only a few drops as recommended by Vogt. It is also worth while to know that 10 cubic centimeters can be used successfully in adults [illegible] we suggest a dose of [illegible] 10 cubic centimeters depending upon attendant conditions of time elapsed since cardiac failure, age of patient, size of patient, quality of adrenalin, and cause of apparent death. We do not recommend this procedure as a substitute for present resuscitation measures but advise its use only after ordinary means have failed.

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FORWARD DISLOCATION OF BOTH BONES OF THE FOREARM AT THE ELBOW

Review of the Recorded Cases and the Literature with Report of Case

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THE case under discussion is of such rare type, that it seems worthy of report with a complete review of the literature. Since Evers first reported a case in 1787, 22 cases have been recorded in the literature, and the present case brings the total reported to date to 23.

In chronological order, the authors reporting cases may be listed as follows: Evers, 1787; Colson, 1818; Leva d'Auvers, 1842; James Prior, 1844; Monin de Mora, 1846; Guyot, 1847; Wittlinger, 1848. With the exception of the case of James Prior, the other 6 were collected in the epoch-making review of Streubel in 1850. Since that time, individual case reports have been made by Ancèlon, 1859; Secrestan, 1860; Canton, 1860; Caussin, 1861; Hutchison, 1866; Fulton, 1897; Platt, 1899; Staunton, 1905; and Isidore Cohn, 1922.

Beside these uncomplicated, forward dislocations, 7 cases of forward dislocations in association with fractures of the olecranon or coronoid have been recorded, in chronological order, as follows: Richet from Boyer's clinic, 1839; Morel-Lavalée, 1858; Richet, 1859; Rigaud, 1870; Mons, 1877; Stimson, 1899; and Batut, 1910.

REVIEW OF THE LITERATURE

Since the first report by Evers, the literature on this subject has been full of contradictions and denials. Other reviewers of this subject, notably Streubel, have been unable to gain access to the original report[1] of this case; for this reason, I believe it of value to record a translation from the original. The translation follows:

Observations on an Afterward Complicated Dislocation of the Cubitum with no Break in the Olecranon

1785 July. A seven year old boy with weak muscles fell from a swing at a considerable height on to his right arm, so that the lowest extremity of the upper arm directly above the olecranon was struck from behind against a large stone.

The cross wound was 3 inches long, with no hæmorrhage — it was directly in the bend of the right arm and out of it were hanging lacerated shreds of aponeuroses, tendons, blood vessels, and nerves. The lower extremity of the humerus projected 2 good inches from the wound, and by the still active force of the muscles the unbroken olecranon had been pushed up above. (See *Treatise on Diseases of the Bone.* M. Petit. Paris, v, 1, p. 232.)

The active force of the fall against the stone was so great that the lower extremity of the upper arm was thrust forward, not only completely dislocated, but as already remarked all the surrounding deep-seated parts were torn from the fracture. I easily and quickly effected the replacing of this luxation. I raised the upper arm as far as possible and extended the forearm at a right angle with the upper arm, and as I thought the necessary extension and contraction had been sufficiently effected I bound the forearm to the upper arm at an acute angle. I did not cut the shreds of aponeuroses, tendons, blood-vessels and nerves hanging from the wound, for fear of fresh hæmorrhage, but left them to detach themselves by ulceration through the subsequent suppuration.

The wound was bound up dry and the necessary compresses were strengthened by a circular bandage. This remained 4 days and as often as it became dry it was moistened with water and wine vinegar in which sal ammoniac was dissolved, and the arm placed in the napkin.

The pulse in the injured arm was not so much increased as it very often is after the operation for false aneurism, but it was more rapid than in a sound person. The much swollen hand was cold rather than warm and, with all the loss of blood, the inflammation and suppuration increased nevertheless.

On the fourth day I had to change the treatment for emollients whereby the necessary suppuration would be hastened, which, as is known, is not great in any aponeurotic injuries.

In the best condition of the arm I could not induce free flow of pus which was hindered by the unusual inflammation and swelling in the bones, while the accumulated and stagnant pus in the joint caused an abscess on the outer condyle of the humerus. After the abscess opened, so that the pus had free outlet, there was consequent pain and fever, and the extreme inflammation and swelling of the bones themselves became very sensible.

[1] Loc. cit. p. 22

I tried to keep down the suppuration by the continued use of an emollient and the resulting infection, but I could not hinder the effect of the great contusion of the under end of the humerus; while during the [illegible] the whole external could [illegible] perceptible hole, without any special effect being observable

From time to time I permitted the arm to move to prevent anchylosis, and for the extraordinary bone swelling I used a [illegible] terebinth with very good results.

By this treatment this very interesting injury and likewise the severe bone swelling and the lacerated ligaments, tendons, blood vessels, and nerves which prevented the free movement of the elbow joints, was fully healed in the course of not quite 4 months.

But the usual sensation of warmth and the pulse in the injured arm were still feeble and the cold hand bent itself inward when left free. I therefore let the blood-filled or collapsed [illegible] large and the influence of moisture in itself limber the entire arm, by bathing frequently with warm soapy water, and while the boy was bathing he moved the arm and hand more freely and the pulse increased.

By this treatment of warm baths the pulse increased more and more and strength in the same degree, as also the feeling of warmth and the free movement of the injured arm, so that the patient was completely cured of this remarkable injury in 5 months.[1]

Boyer (1826) stated: "We have never seen an anterior dislocation of the elbow complicated by a fracture of the olecranon process, and we doubt, though it is possible, if it has ever been seen." He further states: "It is possible that the upper extremity of the forearm can be displaced, backward, forward, or to either side; but, the first one is the only one that has been seen. As to forward dislocation, *it can occur only after the olecranon process has been fractured.*" (Italics mine.)

Sir Astley Cooper in 1832, mentions only five species of dislocations of the elbow. "Firstly, both bones are dislocated backward; secondly, both are dislocated laterally; thirdly, the ulna is dislocated separately from the radius; fourthly, the radius is dislocated forward; fifthly, the radius is dislocated backward." No mention whatever is made of the possibility of a forward dislocation of both bones of the forearm, either with or without a complicating fracture.

[1] Access to the volume [illegible] through the courtesy of the Surgeon General's Library. [illegible]

Montegia [illegible], who only is referred to by Canton and Streubel, "is inclined to believe in the possibility of a forward dislocation without fracture of the olecranon, but maintains that it can only occur [illegible] there is a considerable pathological relaxation of the ligaments." (Streubel)

Delpech "talks of a case of forward dislocation without fracture of the olecranon, but we are not informed if he or someone else has seen this case. . . . He adds in explanation that in this case the [illegible] torn and ruptured, that it would be better to overlook this kind of luxation altogether, and to consider it as entirely [illegible]." (Streubel.

Bérard considers "Forward dislocation without fracture of the olecranon [illegible] able . . . and assumes the one with fracture is only theoretically possible, but by no means practically demonstrated." (Streubel

Richet (1839) quotes from Lauson: "The anterior dislocation of the two bones of the forearm or the arm, that is to say, complicated by a fracture of the olecranon, has been more theoretical, than practical." He also quotes Bérard as follows: "As to the anterior dislocation, complicated by a fracture of the olecranon it is, I think, only from theory that surgeons have been able to describe it, for I have not found one instance in which this accident has been mentioned."

Malgaigne (1823) does not mention the condition at all.

Cheluis (quotation from Richet) admits that "the anterior dislocation of the elbow is possible, but does not describe it in his chapter on luxations or fractures."

Gross in 1859 stated: "Dislocations of both bones of the forearm forward is an extremely rare event, which was supposed to be altogether impossible, without previous fracture of the olecranon, or extensive laceration of the soft parts. Modern observation, however, has shown the fallacy of this opinion, by adducing a number of unequivocal cases in which the displacement existed as a pure, uncomplicated affection." Gross mentions a case of Forbes, of Philadelphia, and another of Hunt, of Chicago, of which I have not been able to find records.

CASE REPORTS

Streubel (1850) collected all of the reported cases, with the exception of that of James Prior and from this work of Streubel's, I shall take the liberty of quoting rather freely, and recording cases in the words of Streubel. One can easily see, from the expressions quoted from the literature, that surgeons prior to 1850 were not convinced that forward dislocation was even possible, and yet at that time, Streubel was able to collect the following six cases:

CASE 1. Forward dislocation of the bones of the forearm without fracture of the olecranon. The first example of such a displacement was observed and described by Evers in 1787; unfortunately, we were not able to get a copy of his book and are therefore unable to judge his case critically.

CASE 2. Colson[1] observed a second case toward the end of the year 1818. He describes it as follows: "A fifteen year old boy, pale and emaciated, but in good health, fell while skating, with the whole weight of his body on the elbow of his right half-flexed arm. The power of the fall had been concentrated on the olecranon, with the result that it was separated from the trochlea and had slipped forward. On examination not long after the injury, the arm was found to be almost an inch longer, the point of the olecranon stood on the lower surface of the trochlea humeri, and the movements of the very slightly flexed arm were rather restricted. It was easy to get the arm in forced extension (hyper-extension), but on flexion, strong resistance was soon met, and the injured boy suffered great pain. Each movement caused the point of the olecranon to move about on the trochlea. The radius had remained firmly fixed to the ulna. Reduction was easily accomplished by extension and pushing the upper end of the forearm backward." We are not told if the patient regained the full use of his arm.

CASE 3. Reported by Leva d'Auvers and quoted by Streubel is in some respects described more in detail than the case of Colson:

"A severe fall on the elbow of the flexed arm was followed by loss of use, with elongation of 1 inch; the olecranon was not on the posterior aspect of the joint, the arm was lightly flexed. The soft parts covering the joint were under high tension. The biceps tendon appeared as a raised cord anteriorly, the sides of the elbow joint were flattened, depressed, and especially posteriorly, there were grooves, corresponding to the altered surfaces of the joint. Below arose the coronoid process of the ulna beyond the biceps tendon, and below it, the sigmoid cavity could be felt. On the upper side of the posterior aspect of the joint, the ends of the bone of the upper arm protruded as two rounded knobs, enclosing a depression, the fossa olecranon. The movements of the arm were very restricted and extremely painful."

Leva reduced it by letting one assistant make counter extension at the shoulder, while a second extended the forearm. He then pushed the ulna forcibly backward, while he pulled the end of the humerus forward. Reduction occurred after a short time with an audible snap. Leva has forgotten to mention if the arm became partly or entirely useful again.

CASE 4. Reported by Monin de Mornant offers several peculiarities which distinguish it essentially from the examples so far cited. "A boy between 6 and 7 years old, had fallen from a rather high wall upon a dumpheap. His arm had been strongly flexed with the elbow pushed out forward. Thus the olecranon was placed almost parallel with the condyles of the humerus. The force of the fall met first the olecranon, pushed it upward and fixed it, so to say, while the lower end of the humerus, pushed obliquely forward and downward by the weight of the body, slipped under and behind the olecranon. The soft character of the material on which the boy had fallen, prevented a fracture of the bones."

In this case, the olecranon stood not upon the trochlea, but lay in front and partly over it. The arm appeared shortened, and the anteroposterior diameter of the joint was considerably lengthened, the arm was slightly flexed, could be extended and also a little further flexed. Monin tried several times to restore the dislocated arm by repeated extension and counter extension, when he remembered how the displacement had occurred with the arm strongly flexed. He now arranged his reduction technique as follows: He let one assistant fix the upper arm at the shoulder, bent the forearm forcibly, causing severe pain to the patient, and gave it to a second assistant to hold in this position. Then he crossed both hands over the bend of the elbow and tried to push the upper ends of the bones of the forearm downward and backward, while both assistants pulled. The point of the olecranon was thus put into a very oblique position toward the trochlea and could be made to slip over it without obstacle. Reduction now occurred very quickly. The subsequent inflammation was quite moderate and after one month, the patient had complete freedom of motion.

CASE 5. Reported by Guyot, at Norges. "A fourteen year old boy had been thrown with great force from a wagon, which had turned over, and fallen on the elbow. The arm became useless immediately. The writer examined the patient after 3 hours. The arm was lengthened by 1 inch, the region of the elbow showed some swelling and the forearm formed a straight line with the upper arm. On the posterior aspect of the joint, a depression was felt in place of the olecranon; anteriorly, there were two eminences, which were also marked on the skin by two round red spots, then followed a groove and

[1] Quoted by Hueter: Traumatische Luxat., Par., 1857, p. 178.

below this, lay the head of the radius exteriorly and the coronoid process with its margins on the inside. The forearm was unusually mobile and could be flexed backward and forward, and even laterally. Reduction was extremely easy, only slight extension and backward pressure on the upper end of the forearm was necessary." Information is not given as to course after reduction and healing.

CASE 6. Reported by Wittlinger. "While exercising in the gymnasium, a young man 18 years old, fell with full force on the forearm and elbow of the right arm, which was flexed and pushed forward. During examination, the writer found both bones of the forearm on the anterior surface of the bone, but the olecranon was missing from the posterior fossa of the joints. The articular surface of the humerus with the two condyles, stood on the posterior surface of the bones of the forearm and formed a marked eminence, the arm itself was almost extended."

This rather short description shows at least that, as in the case of Monin, the olecranon had slipped across the entire surface of the trochlear process lying with the posterior surface of its base on the highest point of the trochlea. The writer believes that the displacement occurred primarily backward and outward and developed secondarily into an anterior dislocation by the olecranon slipping over the external condyle. To reduce, the writer followed his views of the mechanism rotating the forearm outward and then pulling it across the external condyle. This procedure he reports to have been quite easy. After reduction, he surrounded the joint with figure-of-eight bandages, and for 6 days applied cold applications of lead water with ammonia. From the seventh day on, lukewarm aromatic fomentations were ordered and every day, careful movements were made; later on inunctions of gray ointment, volatile liniment, and finally came animal baths. (?) Almost complete function was restored, except that the arm could not be completely extended. A little swelling had remained over the olecranon and the internal condyle."

CASE 7. Reported by James Prior in 1844. Chronologically considered, this case should be placed as the fourth recorded case. Collectively, it is the seventh case found in the search of the literature. The details of the case, as reported by the author, are as follows:

"A laborer, age 34, was winding a weight of some tons by means of a crane when the chain suddenly broke. The handle of the machine was made to revolve violently the reverse way, and struck him on the under side of the left arm at the elbow. Examination showed a large wound on the under surface of the joint, occasioning a general disconnection of the parts, muscular and otherwise, except immediately in front. All of the ligaments were torn. The heads of the radius and the ulna were driven upward on the humerus. The lower end of the shaft of the humerus was denuded of the muscle and ligamentous attachment. Final result: Pa-

hand is held in pronation; the elbow is very painful, [illegible] crepitus. Posteriorly, where the [illegible] Ancelon was called in consultation the following day, and on the swelling and subsidence, he easily recognized that the lateral limb was [illegible] longer. He also noted the crepitus and mobility, which had been found the previous day. On palpation, [illegible] the olecranon on the posterior aspect of the [illegible] trochlear process and below the olecranon, whose tip rested on the medial aspect of the trochlear process. When the [illegible] right angle, it was found that the olecranon formed the point of the elbow 2 centimeters anterior to where it is usually formed. Ancelon diagnosed an anterior dislocation of the elbow, without a fracture of the olecranon. He reduced [illegible] by making traction on the forearm, counter traction on the arm, and then suddenly flexing the forearm. The displacement reoccurred, but was again reduced.

CASE 9. Reported by Caussin in 1861 (*L'Union médicale*). Anterior dislocation of the ulna without a fracture of the olecranon, but complicated by a fracture of both bones of the forearm. On April [illegible] 1861, Caussin was called to see a servant, [illegible] of age, who, while trying to dislodge a sack, caught his blouse and hand in the belt of the fly wheel. There was a small lacerated wound on the dorsum of the hand; there was a fracture of the [illegible] at its middle third. The two fractures were at the same level. There was a deformity at the elbow [illegible] swelling. A complete diagnosis of an anterior dislocation of the forearm without a fracture of the olecranon was made. The posterior aspect of the elbow was flattened and the fingers could palpate the olecranon cavity. The edges of the lower extremity of the humerus, especially the internal condyle, formed a large prominence. The forearm was held in semiflexion. Extension and flexion of the forearm were limited and painful. The olecranon could be felt. No crepitus was obtained, but the [illegible] process was [illegible].

The [illegible] of an attempt was made to reduce the dislocation transversely across the elbow; then, with sudden forced flexion of the forearm, the dislocation was reduced. On account of the existing [illegible] of both bones of the forearm, not sufficient traction could be made [illegible] Hence, [illegible] was used.

The olecranon was not fractured. All movements of the elbow joint were [illegible]

and elbow were then immobilized. After 40 days, the patient was entirely cured.

Case 10. Reported by Secrestan in 1860. "July [illegible], 1860, I was called to see a child 8 years old, who, following a fall on the elbow, complained of pain in the elbow and was unable to use it. The following was found: considerable tumefaction of the left elbow, shortening of the arm, lengthening of the forearm, a deep depression, on the posterior aspect was a soft, irregular, hard mass which was readily recognized as the superior extremity of the line of the forearm; the biceps and brachialis anticus muscles were elevated, the forearm was held in a semi-flexed position. The olecranon process was found in the fold of the elbow, on its posterior aspect. Crepitus was obtained. The olecranon was on a level with a plane passed through both condyles. Attempt at reduction was as follows: while extension was being made at the wrist and counter extension at the elbow, I tried to force the ulna backward, but even though considerable traction was made, the reduction was not accomplished." The forearm was then flexed to a right angle and while traction was made on the forearm and counter traction on the arm, the forearm was gradually hyperflexed. "A clicking sound was heard; immediately, I knew that my efforts had been crowned with success; I could feel the olecranon process posteriorly. The luxation had been reduced." The arm was immobilized for a few days and kept moist with lead water compresses. The swelling slowly disappeared, and after 25 days, the limb had regained its normal movements.

Case 11. Reported by Canton in 1860. A case of dislocation of the ulna forward, at the elbow, without fracture of the olecranon process. The details of the case are of particular interest, because it became necessary to amputate the limb. A very careful description of the dissected specimen is reported by the author. The notes, as given by Canton in report of the case, follow:

"The following case came under my care in the Charing Cross Hospital. F. P., age 40, a somewhat short, slimly built, but muscular man, while driving in a light cart at the rate of 7 or 8 miles an hour, was thrown out, and instinctively extended his right hand to prevent injury to his head. The weight of the body, however, caused sudden and forcible flexion of the elbow, and at the same time, the forearm became twisted in under his chest. On rising, it was found that the elbow was considerably swollen, and the power of moving it entirely lost. When admitted into the hospital, the forearm was forcibly flexed and the hand supinated. The swelling, ecchymosis, and tension around the elbow were so great, that it was with difficulty that any of the more salient anatomical peculiarities of this part could be recognized as everything appeared, in every way, so disarranged. The skin covering the inner condyle was stretched to the utmost, and here, over a space about the size of a sixpence, it was injured to such a degree, that a compound state seemed to be momentarily threatened. The antero-posterior and lateral diameters of the joint were increased in extent, and the general swelling was so great as to present a circumference far beyond the normal size of this region. Externally, and somewhat anteriorly, the cup-like cavity of the radius could be indistinctly distinguished; internally, the condyle was unduly prominent; anteriorly, no particular point for diagnosis could be determined on, on account of the state of forcible flexion and great tumefaction there; posteriorly also, the swelling was very considerable, but below it, there existed a depression favoring the view that the ulna was broken immediately below its olecranon process. No median gutter, with lateral elevations to bound it, could be felt.

"Attempts were made to rectify the mal-adjustment, but without success. The efforts, however, could not be longer continued, for it was obvious that the injury already sustained by the soft parts was so extensive, the obstacles to be overcome so resistent, and the great likelihood incurred of rendering the case one of the compound kind, forbade further trial, and it was agreed, in consultation, to place the limb at rest on a splint, and to keep the parts cool with an arnica lotion. However, within the course of 48 hours the tumefaction became still greater. A large slough was forming on the inner side of the joint, and high constitutional irritation having set in, I was obliged to amputate the limb at a sufficient distance above the articulation.

"*Dissection.* A very careful examination of the elbow was made, under my superintendence, by my pupil, Mr. Edgar Browne, with the following results:

"*Bones.* The ulna was dislocated forward, so that the upper surface of its olecranon process became placed in front of the capitellum humeri and had thus assumed the position naturally occupied by the head of the radius during flexion of the forearm. The radius was supinated and maintained *in situ naturale*, as regards the ulna, by the coronary and interosseous ligaments being intact.

"*Ligaments.* Of the anterior ligament, the only part remaining at all perfect, was a shreddy portion about the center; all the rest of it had been torn through. The posterior, and both lateral ligaments were completely divided. The coronary and oblique ligaments were uninjured.

"*Muscles.* The triceps extensor was detached from all of its points of insertion. The supinator radii longus was uninterfered with at its origin, but the two radial extensors of the carpus beneath it were torn away from the surfaces whence they spring. All the muscles which arise from the external condyle, with the exception of the supinator radii brevis, and anconæus, were detached from this process. The only muscle that was torn through at its origin, from the internal condyle, was the flexor carpi ulnaris. The olecranon and ulna portions of it, however, continued intact. No mischief whatever had happened to any other of the pronators

and flexors. The biceps and brachialis anticus were greatly on the stretch.

"*Blood vessels.* Though much shifting of their positions had necessarily taken place, no vessel of large size had been injured, the artifice, however, of smaller ones must have been great — judging from the large amount of blood with which all the soft tissues were infiltrated.

"*Nerves.* The ulna nerve was torn across where it passes behind the inner condyle. The sheath of the median was distended, and its substance permeated with blood. The other nerves were uninjured."

Case 12. Reported by Jonathan Hutchison, in 1866. Hutchison states that the case had been observed by one of his friends, and late pupils, Mr. E. Greenaway. There is very little detail given. The following was abstracted from his report:

"Mr. Greenaway informs me that the symptoms were very definite, the forearm lengthened; the condyles of the humerus prominent below and behind the olecranon; the projection of the latter bone being quite lost. On bending the limb, the bones slipped into place almost spontaneously. The motions of the joint were quite restored after reduction, and the man did well."

The accident had occurred from a fall in a bar room in which the extremity of the elbow was struck.

Case 13. Reported by H. D. Fulton in 1897. The following, abstracted from Fulton's article, gives all of the details contained in the report: "A man middle aged, rather muscular in build, was intoxicated at the time of the accident, and thrown from the step of the train. The entire weight of his body was sustained by one arm when the luxation occurred. There was no fracture of the olecranon. The end of the humerus formed a large prominence, posteriorly causing a marked and sufficient characteristic deformity. The radius and ulna were completely displaced upward on the anterior surface of the humerus."

Case 14. Reported by J. E. Platt, in 1899. The case was under the care of Mr. Ray, resident surgical officer at the Manchester Royal Infirmary, to whom I am indebted for the following details: "Complete dislocation forward of upper ends of radius and ulna without fracture of the bones. The patient, a boy, age 13 or 14 years, attending the Manchester Grammar School, was attempting a 'set-off' from the parallel bars in the gymnasium, when he miscalculated his distance and fell to the floor. The palm of the left hand, with the elbow almost fully extended and with the arm behind the body, came in contact with the ground. Afterward the patient rolled over upon his left side and upon the injured limb. He was removed at once to the Infirmary, and was seen by Mr. Ray within 20 minutes of the occurrence of the accident. The elbow was flexed to a right angle and was fixed firmly in that position. The forearm appeared to be lengthened. Seen from behind, the characteristic outline of the lower end of the humerus was easily recognized, owing to the skin and triceps tendon being tightly stretched over the [illegible]. The [illegible] was lodged at the [illegible] of the trochlea. On the front of the upper part of the [illegible] the head of the radius and the upper end of the [illegible] made out without difficulty. Pain did not appear to be unusually marked.

"It was evident that [illegible] dislocation at the elbow joint. No evidence of fracture was present, either before or after reduction. Reduction was performed without the administration of an anesthetic. After [illegible] flexion of the elbow [illegible] was carried out in the line of the humerus and with pressure of the knee against the upper part of the forearm.

"The radius and ulna then traced in succession and occupied the position of outward, and backward dislocation. From the last position, reduction was easily accomplished. It appears probable that the bones actually retracted the steps of backward and outward dislocation, through which they had been carried at the time and by the nature of the accident. The after progress of the case [illegible] uneventful, and when the patient was last seen [illegible] 5 weeks after the occurrence of the accident there was scarcely any impairment of the full movements of the elbow-joint."

Case 15. Reported by Staunton in 1905. "Patient fell, striking point of elbow. It could be slightly flexed and extended and permitted a good deal of lateral movement. The head of the radius and the olecranon process of the ulna could be felt lying on the shaft of the humerus, about 2¼ inches above the condyles."

Case 16. Reported by Isidore Cohn, 1922. Mr. P., age 50. Diagnosis: forward dislocation of both bones of forearm; fracture of both bones [illegible] third. Seven weeks ago, patient sustained injury for which he came under observation. Forearm was caught in a governor belt and dragged across the crank shaft. The skin of the forearm was lacerated, there was immediate loss of function in the elbow and forearm, and the patient supported his right hand in the palm of the left. Great pain followed the accident. He was attended within [illegible] of the accident by physicians, who gave him an anæsthetic and "immobilized the fracture" in plaster for 10 to 14 days. The pain persisted, and the bandage became very tight, causing the fingers to swell. Again the arm was manipulated and a cast reapplied. Four weeks after the accident, the arm was again examined and manipulated; and cast reapplied. At the end of weeks, the third examination was made. An X-ray picture was taken and the patient told that the bones were not in good position. He was advised to have an operation done.

I first saw him December 6, 1921, at which time the following notes were made:

There was marked œdema and swelling of right arm, forearm, and hand. The elbow was fixed to a right angle, and the patient supported the forearm in the palm of the uninjured hand. The circumfer-

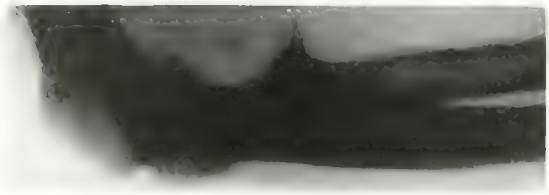

Fig. 1. Anterior dislocation of elbow before reduction. Case of Mr. P.

Fig. 2. Anterior dislocation of elbow before reduction. Case of Mr. P.

circumference of the right arm was 32 centimeters, the left arm, 23½ centimeters, right wrist, 20 centimeters, and the left wrist 17½ centimeters.

The right elbow, when viewed from the side, is broad, and there is a marked prominence, 1 inch below the external condyle posteriorly. The anteroposterior diameter of the elbow is greatly increased. Palpation of the arm shows the swelling to be of a brawny hardness in places, and soft œdema in other places. There is no pain over either condyle of the humerus, or over the posterior aspect of the elbow. Patient was unable to flex his elbow through a greater arc than fifteen degrees. There is an angular deformity of the middle third of the forearm. The styloid of the radius is lower than that of the ulna. There is a localization of pain over the radial styloid and over the shaft of the radius on a higher level. Flexion, both palmar and dorsal, at the wrist, are greatly limited; and the fingers are stiff. The X-ray picture taken immediately, showed a complete anterior dislocation of the elbow, the olecranon lying entirely in front of the trochlea and well up on the shaft of the humerus. There was no evidence of a fracture of the olecranon. The picture of the forearm showed a fracture of both bones of the forearm with marked lateral displacement of both radius and ulna; there is also an overriding deformity, particularly of the ulna; and a small fracture of the styloid process of the ulna. The styloid of the radius is on a much lower plane than the styloid of the ulna.

The condition of the skin and the great amount of œdema present, made it advisable to delay operation for several days, during which time he was given hot baths, massage, and dry heat.

The operation was performed on December 9, and the following is a copy of the operative detail: "Operative reduction of anterior dislocation of the right elbow joint." Preoperative diagnosis: anterior dislocation of the right elbow joint with ankylosis. Unreduced fractures of radius and ulna (right forearm) at the middle third.

Postoperative diagnosis: Anterior dislocation of the right elbow joint with ankylosis. Unreduced fractures of radius and ulna (right forearm) at the middle third.

Incision was made on the outer side of the humerus, beginning about the junction of the middle and lower third, extending down the forearm about 4 inches. The radial nerve was exposed before its entry into the supinator longus muscle. The supinator was then retracted outward and the humerus approached subperiosteally between the supinator longus and the brachialis anticus. The vessels, along with the muscles and periosteum, were retracted upward. We found that the head of the radius was above the normal level and anterior to the external condyle, separated from it about three-quarters of an inch. When the capsule was opened, we found a large quantity of blood and we noted then, that there were several small fragments of bone in the olecranon fossa. The olecranon fossa was anterior to the internal condyle and rotated outward. We then saw that there was a mass of muscle tissue interposed between the olecranon and the trochlear process. An attempt was made to replace this, but this we were unable to do. Therefore, we decided to make an incision over the internal aspect of the elbow, exposing the mesial aspect of the humerus and the ulna. At this stage we noted that all the group of muscles originating from the internal condyle were interposed between the internal condyle and the olecranon. An effort was made by retraction and manipulation to get these muscles out of the fossa, but we found it impossible. After several attempts, it was decided that it was necessary to cut these muscles to obtain reduction. Then we were able, after some difficulty, to bring the condyles of the humerus in front of the olecranon fossa. The finger introduced into the olecranon fossa of the humerus, showed it to be filled up with soft tissue and rather than dislocate the lower end of the humerus out of the wound, I used a sponge, and removed what portion of soft tissue I could from the olecranon fossa. We then removed a small fragment of the tip of the olecranon, after which we were able to reduce the dislocation. Muscle sutured. It was not thought to be possible to do an arthroplasty, owing to the fact that no fascia over the triceps region was available. It was decided simply to suture the muscle planes, leaving the capsule open on the inside for drainage. The ulnar nerve was not injured. The wounds were sutured with silk worm and Michel clips. No large vessels were injured and a tourniquet was not needed.

The arm was put up in complete extension, because in that position, there would be less tendency toward a recurrence of the dislocation. Therefore, an anterior and posterior plaster splint was applied.

No effort was made to operate the fracture of

Fig. 3. Fracture of both bones of forearm associated with anterior dislocation of elbow. Case of Mr. P.

both bones of the forearm at the time was so late that the procedure would be needlessly long, which the patient's condition did not justify, and secondly, early mobilization of the elbow might have been dangerous to a successful result of the fractured forearm. The forearm muscles needed massage and mobilization and not immobilization.

Further, relative positions of the styloids of the radius and ulna indicated that a good functioning wrist might very well be expected if union occurred in the position as shown by the picture.

Progress notes. December 6, 1921. Patient admitted with old fracture of forearm and anterior dislocation of elbow of right arm. Carries arm flexed at elbow, forearm in splints and supported by sling. All movements limited; no pain, however, when supported as above stated. Patient ordered to have arm soaked in green soap solution each day and baked, 1 hour a day.

December 7, 1921. Usual routine orders carried out today. Patient feels better.

December 8, 1921. Patient has kept up routine orders today. Arm is much cleaner. Can flex fingers much better. There is considerable pain when arm is moved out of usual manner it is carried.

December 9, 1921, 9 a.m. Operation. Respiration after operation was as low as fourteen 6 p.m. Respiration still fourteen. Sensation in fingers normal. Slight bloody discharge on dressing.

December 11, 1921. Temperature 99.6°. External dressing changed.

December 14, 1921. Dressing changed. Two stitch abscesses on outer side of arm. Elbow manipulated range of motion about 90° from full extension to beyond right angle. Patient seems to be in good condition. Temperature after manipulation 102°.

December 15, 1921. Arm redressed. No evidence of any infection in the wound. Range of motion of about 160° to 60° without any pain. Temperature 99°. Patient seems in good condition. Sutures and clamps removed. Passive motion.

December 17, 1921. Dressing. Large amount of synovial fluid and blood discharged when elbow is flexed.

December 19, 1921. Dressing changed. Serous discharge from joint. Wound looking well. Slight œdema and redness about joint. Motion about 80 to 90°.

December 21, 1921. Wound dressed. Serous sanguinous discharge. Passive motion.

Fig. 4. [illegible] Case of Mr. P.

March [illegible]. When first seen by [illegible] extend the arm to [illegible] fractures of the forearm. There was greater freedom of motion of the [illegible]

FORWARD DISLOCATION OF BOTH BONES OF THE FOREARM COMPLICATED BY A FRACTURE OF THE OLECRANON.

1. The first recorded case of a forward dislocation of both bones of the forearm complicated by a fracture of the olecranon, was reported by Richet from the clinic of Phillips Boyer, St. Louis Hospital, Paris. This case has been reported in detail, in the work of Streubel and the following abstracted from that classic review, gives the interesting phases of this first case:

A robust mason, 18 years old, fell backward from a high tree, falling on his [illegible]. The patient was immediately transferred to the St. Louis hospital. The left elbow was [illegible] with an increase in the anteroposterior diameter of the joint. The forearm was in supination and slightly flexed toward the upper arm. Any directed movement of the forearm was impossible for the patient, owing to the flail character induced by the injury. On comparing the measurements, it was found that the affected arm from the internal condyle to the styloid process of the ulna was shortened by almost an inch; from the external condyle, which was less prominent, to the styloid process of the radius, the

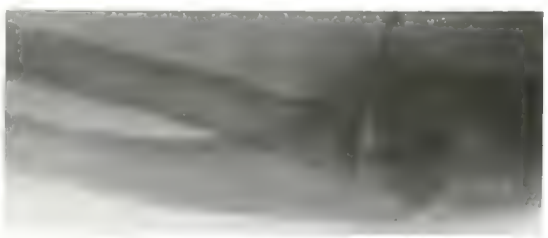

Fig. 5. Same case after reduction.

shortening was three fourths of an inch. On the posterior aspect of the elbow, the olecranon, which was movable in both directions, formed a prominence 1 inch in length, though this was located in the normal position of this process. Two inches below the olecranon was a wound of about one-half inch diameter, from which a bone splinter protruded. Below this wound, the examining finger slipped into a depression below which the continuity of the bone could not be farther followed. There was also a depression on each side of the olecranon. Anteriorly, the articular fold was deformed as follows: A finger's width above the condyles one felt a round, hard, resistant swelling which seemed to lie deep in the tissue and lifted the biceps and the brachialis internus upward. When the forearm was flexed and extended, it could be felt that the swelling in the articular region was movable and during pronation and supination, it rolled toward the outside. Crepitation was plainly felt, but only such as is produced by the rubbing together of eroded cartilaginous layers. The hand was excoriated on the palmar surface, and showed traces of contusion which left no doubt that during the fall this part bore the weight of the body. From these facts Boyer diagnosed the injury as a forward dislocation of the forearm with a fracture of the olecranon. Reduction was immediately decided on. Extension and counter extension were made, the upper part of the forearm pushed back, and the arm suddenly flexed. The attempt was successful, all deformities disappeared; but, after an involuntary movement of the patient, the luxation returned. It was again reduced in the same way, and the arm put in a bent wooden splint surrounded with bandages and pillows. Three hours after reduction, the patient died with symptoms of collapse.

During autopsy, an enormous hæmorrhage was found in the lower pelvis, which had undoubtedly caused death. The brachial artery, median nerve, and median vein, had been only slightly displaced toward the inside. The biceps was contracted and described a curve, where it passed over the anterior part of the swelling, and hæmorrhage had occurred between the brachialis internus, the biceps, and supinator longus. The superficial layer of the bundle of muscles inserted in the internal condyle was intact, but the deeper part was entirely torn. This tear included the entire lateral ligament on the inside, while the external lateral ligament was almost intact. The brachialis internus was the muscle which had suffered most; its superficial part was contused, its deeper fibers entirely torn. The soft parts behind the joint showed the above-mentioned wound, which extended into the articular cavity. The triceps was inserted along the entire posterior fragment of the ulna, which for a distance of 2 inches had preserved its fastenings on the inside to the extensor capulnaris on the outside to the anconeous parvus, so that it was held in its normal place by the muscle fibers. This anatomical finding shows why the olecranon had not changed its position. The lower articular surface of the ulna showed in its posterior part a longitudinal fracture, which ran from above and forward in a posterior inferior direction, so that the anterior fragment included the body of the bone with the coronoid process; while the posterior one comprised the olecranon and an obliquely split piece of bone 1.5 inches long, which protruded downward through the wound in the soft parts. The bone of the upper arm lay behind the bones of the forearm, which had been pushed up about one-half inch beyond the condyles. The annular ligament which had remained intact, had helped to pull the radius forward. The posterior surface of the ulnar fragment was corrugated and touched the articular end of the humerus, which through friction of this fragment, had suffered a superficial loss of cartilage. The joint capsule was almost entirely torn, which accounts for the mobility of the parts, the facility of reduction and also the relapse. Streubel also mentions the pathological specimen of Dupuytren, but as you will note by the quotation, no data is given concerning where the specimen was obtained; and therefore, cannot be recorded as an authenticated case.

"The fracture had severed the ulna in such a way that the upper fragment included the inner half of the coronoid process and the entire olecranon a little below its base; while the lower fragment comprised the entire ulna with the exterior half of the coronoid process. The upper fragment had been dislocated backward and somewhat toward the inside, but the olecranon was still lying in its fossa. The lower fragment with the radius had been pushed in front and about one-half inch upward."

In the same year, 1839, Richet records the following case:

Observations in a forward dislocation of the upper extremity of the bones of the forearm, complicated by a fracture of the ulna. He cites a case of a man falling for a distance of 45 feet. The left elbow showed considerable deformity; the anteroposterior diameter was increased, the lateral diameter was practically normal, the arm was held at right angle and completely fixed. The left forearm (from internal condyle to styloid of ulna) is 1 inch shorter than right. Reduction was easily accomplished by making extension on the forearm; by counter-extension on the arm, and then suddenly flexing the forearm. The forearm was immobilized at a right angle to the arm.

There is no proof that this is not the same case as mentioned by Streubel. The only thing which suggests that there are two separate cases, is the fact that in one instance, the author stated that the reduction was easily accomplished, and in the other instance, it is recorded that the patient died within 3 hours. We would suggest that the cases are apparently one, not two.

Case 3. Reported by Morel-Lavalée in 1858. This case is unusual, because it seems to be the first recorded case of an anterior dislocation of the forearm, complicated by a fracture of the coronoid

process. The report, as abstracted from the original, follows:

On September 14, 1858, a young man [illegible] brought in with the following histor[illegible]

He was lying in a buggy, when suddenly the horse became frightened. Patient tried to jump, but fell on his right side; the wheel passing over the anterior aspect of the elbow from without, inward. The following day, the elbow and forearm were so swollen that they appeared twice the [illegible] arm. The bony landmarks around the elbow were not evident. As the individual was quite muscular, it was impossible to make more than a [illegible] diagnosis, that is, a fracture of the base of the olecranon with a wound entering into the joint cavity.

The active movements of the forearm were absent, but all the passive movements, especially extension and flexion, were practically normal; all were painful. The pulse in both arms was normal, thus showing the brachial artery had escaped injury. A second lacerated wound was found over the internal condyle and a third over the external.

The following day, the swelling had increased and was associated with a high fever. The [illegible] hot, glazed, and thin. A diffuse phlegmon was found, and extensive débridement was practiced. On the 20th, two collections of pus having been found on the lower external portion of the arm, and on the superior inner aspect of the forearm, two incisions were made to evacuate the pus. The index finger was introduced into the incision over the inner aspect of the elbow and having the forearm flexed at a right angle the trochlear process could be felt; the two bones of the forearm could be felt anterior to the humerus. He then made a diagnosis of an anterior dislocation, complicated by a fracture of the olecranon. At the end of the index finger, a hard, movable mass was felt on the anterior aspect of the ulna. On a second exploration the following day, it was found that the forearm was not dislocated directly anteriorly, but anteriorly and laterally. On September 26, the patient had a severe chill, and as another occurred the following day, it was deemed advisable to sacrifice the limb before a septicæmia occurred. On September 27, the arm was amputated at the level of the insertion of the deltoid muscle.

On examining the amputated specimen, a tract filled with pus and communicating with the joint cavity was found extending upward to the lower third of the arm and downward to the upper third of the forearm. The coronoid process was fractured transversely, and was completely rotated. The muscles attached to the internal condyle were barely recognizable, having been destroyed by the external violence and suppuration. The muscles attached to the external condyle were intact; the [illegible] ever, were torn. The luxation could be produced just as easily as it could be reduced.

In 1850, Richet recorded a [illegible] as follows: "A man fell from the top of an omnibus. He had a dislocated hip and elbow. The first [illegible] fracture of the olecranon process, which had been forcibly separated as if cut with an ax. The [illegible] great that the skin was also lacerated. The finger was introduced into this wound and easily passed into the joint cavity. The luxation was [illegible] recurred immediately.

[illegible] know whether I should try to put the arm in a [illegible] tion which would be most serviceable to the individual. I reduced it and immobilized the forearm at a right angle to the arm; suppuration occurred, the arm healed with ankylosis. The patient is using the arm very well."

The next recorded case, is that of M. Rigaud [illegible] in 1870.

[illegible] purative arthritis ensued. A few days later, an amputation was performed. The articular cartilage of the humerus was ulcerated at its upper borde[illegible] [illegible] the trochlear [illegible]

In 1877, Mons recorded forward dislocation of the ulna, with a lateral displacement of the radius. The case report, as abstracted from the original article [illegible]

[illegible] German Infantry Regiment, named Possuer, was admitted to the military hospital with an injury to the left elbow joint. The history was given as follows:

"During jumping exercises over a box, the man had taken a good start, but had suddenly become afraid to venture the jump, when he had arrived [illegible] the box. Having taken such a strong running [illegible] he was unable to check the impulse quick enough to avoid hitting the box, and struck its edge, with his elbow joint completely flexed, directly on the olecranon (Malgaigne). The pain caused by the blow and inability to use the joint caused him to ask the [illegible] to have him sent to the hospital. Immediately on his arrival, I had him undr[illegible] and three-fourths hour after the injury, the following condition was found:

"The left arm is slightly flexed, supported by the right, and shows a shortening of about 3 centimeters. The diameter of the elbow joint is increased in an anteroposterior direction, the soft parts surrounding it are swollen. On the radial side, an emin[illegible] [illegible] manual examination, the posterior fossa is found completely empty; but on the flexor side, 3 centimeters above the bend of the elbow, the olecranon can be plainly felt, wedged with its tuberosity into [illegible] [illegible] external [illegible] through the tightly stretched skin, the plate-like, upper articular surface of the radius is plainly palpable. Without a doubt, we had to deal with a forward luxation of the ulna, without fracture of

the olecranon; for in that case, it would have remained in the posterior fossa, and an external luxation of the radius. The latter also is very rare and has been observed only once by Nélaton, and then only as an incomplete displacement; while in the case described, the articular surface of the capitulum radii was in a line with the fossa anterior mior.

"As chloroform was not immediately available, the swelling of the joint had increased during examination and professional assistance would have to be sent for, I tried to make immediate reduction.

"I had an orderly fix the upper arm and while vigorously extending the forearm, increasingly pronating it at the same time, I plainly saw the olecranon descending. As soon as it had slipped under the articular surface of the bone of the upper arm, I suddenly stopped the extension and now I heard a snapping sound, the entrance of the olecranon into the fossa posterior. The reduction was entirely successful, for the capitulum radii, pulled down by the extension, had also resumed its normal articular relation during pronation. The olecranon was now examined for a possible fracture during the process of slipping back into its place, but such was not found. The patient was now put to bed with the joint slightly flexed, and a moderately tight flannel bandage was applied. The arm was supported by a bran pillow and a large ice bag put over it.

"The next day, the swelling had considerably increased. There was no doubt that the ligamentum radiale cubiti posticum, capsularo, annulare and interosseum had been torn by the injury and that considerable hæmorrhage had occurred. It was only after the second day, when the discoloration had begun, that the wide extent of the extravasation became discernible. The entire arm, from the hand to the shoulder, turned green and yellow. On July 12, the swelling had already considerably decreased; the ice bag was replaced by hydrotherapeutic treatment, which was followed on July 17 by applications of liquor plumbi subacetatis. On July 25, the normal outline of the joint began to be visible, and flexion and extension were less painful. August 5, regular passive motions were commenced, which had to be interrupted again on August 15, on account of returning swelling. After applying a few leeches, this disappeared again within 3 days. On August 25, the mobility of the joint was almost normal and pain less; and on September 4, the patient could be discharged from the hospital as completely cured and fit for duty. Up to today, the end of September, he could perform his various duties without any difficulty. As I was unable to find a similar dislocation in the literature accessible to me, I thought that its publication would be of some interest. With such extensive injury to the system of ligaments, it must be considered as a very lucky coincidence that the patient could be discharged fit for duty and completely recovered."

Stimson, in 1899, reported a case in his treatise on fractures and dislocations of a forward dislocation of both bones of the forearm, associated with a fracture of the olecranon. He doesn't give the details regarding the case.

Batut, in 1910, recorded an old dislocation of the elbow complicated by supracondyloid and fracture and anterior dislocation of the head of the radius. This case, of course, does not properly belong in this series, as there is only an anterior dislocation of the head of the radius. Reports abstracted from Batut's work relative to this by Dr. Paul G. Lacroix, from the original, follow:

"After many attempts to reduce an anterior dislocation of the head of the radius complicated by a supracondyloid fracture, M. Foutan of Toulou, finally plated it and there employed massage for a period of 6 to 7 months. Six years later the case was seen by the author who found that flexion of the forearm was normal, but extension was limited to about 130 degrees. The right forearm was 3 centimeters shorter than the left. The anteroposterior diameter was increased. The ulna was normal. No trophic disturbances were noted." Even though extension was limited to 130 degrees, the author decided not to operate. He advocated active and passive exercise, massage, and contrast baths as a means of increasing the mobility of the elbow joint.

ETIOLOGY — MECHANISM OF DISLOCATION AND PATHOLOGY

In reviewing the literature, it is found that by far the greatest number of cases of uncomplicated forward dislocation of the elbow have resulted from a blow on the flexed elbow. One case occurred following the forearm being caught in a fly wheel (Caussin). One case resulted from the handle of an unwinding chain striking the patient on the under surface of the left elbow. The cases complicated by a fracture of the olecranon or coronoid resulted from a fall on the hand; a fall on the flexed elbow; or as in one case, the result of the wheel rolling over the elbow.

The majority of authorities have considered the fall on the flexed elbow as the most likely method of the production of this deformity. Colson and Huguie, after studying their case and making experiments on the cadaver, reported the following results:

"Forward dislocations without fracture of the olecranon may occur in three ways: first, by forced flexion of the forearm; second, by fixing the upper arm and turning the forearm around the axis of the forearm; third, by hyperextension of the forearm."

Though this work was done nearly one hundred years ago, there seems to be little to

add in regard to methods by which this deformity can be produced, as all of the cases which have been reported, have resulted from one of the three mentioned possibilities.

The pathology in all cases is one of extensive laceration of the ligaments about the joints, and extensive injury to the muscles; or stripping up of the muscles from their bony attachment. These points can be readily verified by referring to the individual case reports.

The results which have been obtained in the uncomplicated cases are not stated in six, and are given as "cured or almost complete usefulness," in seven. There was an amputation in one case. In the cases complicated by fracture of the olecranon or coronoid, there were three amputations, two cured and one improved. From the foregoing, it would seem that the prognosis should be good, provided the patient is seen early enough, and the injuries to the soft parts not sufficient to call for an amputation. When seen late, as in the author's case, operative reduction offers the only possible method of obtaining a useful elbow. Furthermore, where there is so extensive a stripping up of the muscle from the bones as was illustrated in the author's case, where there was an interposition of soft parts between the respective joint surfaces, there is *no possibility* of reducing the deformity except by an open operation.

CONCLUSIONS

Anterior dislocations of both bones of the forearm are rare. Only twenty-three cases, including the case herewith reported, have been found in a review of the literature. In all cases which have been verified by operation or autopsy, there has been an extensive laceration of the ligaments about the joint and a stripping up of the muscles in the immediate vicinity from the respective bones.

Anterior dislocations of the elbow may be either uncomplicated, or associated with a fracture of the olecranon or coronoid process. A review of the literature suggests that some of the cases have been reduced with very little difficulty.

The case which forms the basis of this report, showed that there was an extensive stripping up of muscles and interposition of soft parts between the lower end of the humerus and the [illegible] impossibility of a non-operative reduction, particularly [illegible]

The approach to the elbow in such instances had best be done by lateral incisions rather than the linear posterior incision, or the method recently suggested by MacAusland. The position after operation had best be out of complete extension, because the olecranon in complete extension is fixed in the olecranon fossa behind the trochlea. If the elbow is put in hyperflexion there is a tendency of the olecranon to slip forward again and reproduce deformity. After a few days it is advisable to begin mobilization of the joint.

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SUBASTRAGALOID DISLOCATION OF THE FOOT

By BEVERIDGE H. MOORE, M.D., Chicago

SUBASTRAGALOID dislocation of the foot, in which the os calcis and the scaphoid bone are displaced from the astragalus, while the astragalus retains its normal relation with the tibia and fibula, is a rare injury.

Sir Astley Cooper, in his book *Fractures and Dislocations*, describes two cases which he saw and reduced in 1815. He considered the injury as a dislocation of the astragalus.

Broca, in 1853, collected the cases reported, classified them, and gave the name subastragaloid dislocation of the foot, to the injury. In considering the foot as dislocated from the astragalus, he conformed to the standard nomenclature of dislocations. In his classification he recognized three varieties, naming them, outward, inward, and backward.

Malgaigne later added a fourth variety, dislocation forward. He reversed Broca's nomenclature by considering the astragalus as the dislocated bone. This variation in the naming of the displacement has caused some confusion, but Broca's nomenclature is that generally followed now.

The German writers classify the varieties as, abduction, adduction, and sagittal subastragaloid dislocation of the foot. This has the advantage of giving a clearer mental picture of the deformity.

The latest complete reviews of the literature are by Dietz in German (1906) and by Baumgartner and Huguier in French (1907).

OCCURRENCE

It is a rare injury. Trendel states that in his clinic only one case was seen in 10 years. However, Stimson says that in a nine-year period at the Hudson Street Hospital, there were five subastragaloid dislocations, five total dislocations of the astragalus, and five dislocations of the entire foot from the tibia. During the same period there were 1089 adduction and abduction fractures of the ankle. It seems from this that subastragaloid dislocation is about as common as other dislocations of the foot, which are all of relative infrequency in comparison with fractures in this region.

As to the relative frequency of the varieties of subastragaloid dislocation, of 85 cases collected by Baumgartner and Huguier, 48 were inward, 26 outward, 7 backward, and 4 forward.

CAUSES

The history of the cases usually is that of a fall from a height in which the weight of the body is received on the abducted or adducted foot, or a violent blow, as from a falling weight, on either side of the lower part of the leg. The same causes act to produce fracture of the malleoli, dislocation of the entire foot, total dislocation of the astragalus, and fracture of the astragalus. These injuries seem to be alternative, the production of one rather than another depending on some factor which cannot be explained, entirely.

The three cases reported here were all of the outward variety. One was recent and the others of long standing.

CASE 1. W. A., male, age 50, a painter, entered Cook County Hospital August [illegible] 1911. A few days before he had stepped off a ladder and fallen about 9 feet, landing on his feet. He did not know the exact position of his feet when they struck the floor but he had fallen to the right after striking. The right foot had swelled immediately and he had not been able to use it at all. When seen the right foot and ankle were much swollen and ecchymosis was intense on both sides of the leg for about a third of the distance to the knee. The foot was moderately everted and abducted. Palpation was difficult on account of the swelling, but a bony projection could be made out on the inner side of the foot, below and in front of the internal malleolus. There was marked tenderness in this region and also over the external malleolus which seemed to be bent outward. Motion of the midtarsal joint and of the ankle was impossible on account of pain. He also complained of numbness of the great toe. The tentative diagnosis was, fracture of the lower end of the fibula with dislocation of the foot, outward.

The X-ray showed outward and slightly backward dislocation of the os calcis and scaphoid from the astragalus, with slight comminution of the lower portion of the anterior end of the os calcis. There was also a fracture of the fibula about 1 inch above its tip.

Closed reduction under ether anæsthesia was accomplished as follows: The knee was flexed to relax the gastrocnemius. An assistant grasped the forefoot while the operator held the heel and ankle with both hands. Traction was then made on the forefoot and an attempt made to invert it. At the same time pressure was made outward on the internal malleolus and inward on the heel. After some manipulation in this manner, the foot slipped into place with a sudden snap, and the projection on the inner side of the foot disappeared. So far as could be made out by palpation the reduction was complete. A plaster cast was applied, holding the foot inverted and at a right angle to the leg.

The following day the patient stated that the pain was all gone and that the foot "felt natural" again. The numbness of the great toe had entirely disappeared. The X-ray showed complete reduction.

The cast was left on for 6 weeks, after which adhesive strapping was used for 3 weeks longer, while weight-bearing was begun. He went to work at that time and reported at the end of another month that he was having no trouble with the foot. He was seen at that time and examination showed the ankle somewhat thickened, but with normal extension and dorsi-flexion. Lateral motion was limited moderately as was the motion at the mid tarsal joint.

CASE 2. C. L., male, age [illegible] a hotel porter

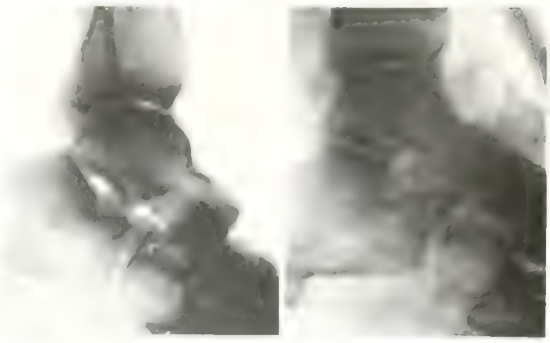

Fig. 1.—Case [illegible]. Lateral [illegible] and [illegible] relations.

entered Cook County Hospital August [illegible] 1911. His complaint was pain in the right foot after use, lameness and deformity of the foot. The foot was injured 15 years before. At that time he was working in a steel mill. While squatting down with the right knee completely flexed and his weight resting mainly on his right foot, a steel rail fell across the lower part of his right thigh. His right foot was twisted violently. He states that the foot was turned outward. An attempt was made to correct the deformity and a splint was applied. He was kept in bed for a month after which he began to walk, though it was very painful. After the swelling subsided the foot was still turned outward and there was a large "lump" on the inner side of the foot just in front of the ankle. This gradually became more prominent and the foot became more flattened and turned out as he used it. With specially made shoes he had been able to continue working at odd jobs, though he limped badly and walking was very tiresome.

On examination, the right foot was found much everted and abducted. It was shorter in front of the tibia than the sound foot. The internal malleolus was nearer the sole than normal. The external malleolus was displaced forward on the outer side of the foot. About an inch in front of the external malleolus and just below its level there was a rounded bony projection, about the size of a walnut. The ankle motions were normal except the lateral motion which was much limited. Motion at the mid tarsal joint was very slight. There was marked hallux valgus of both feet, more marked on the right. On weight-bearing the eversion was increased so that the projection on the inner side of the foot almost touched the floor. On walking the whole leg was voluntarily rotated outward so that the foot was almost at a right angle to the line of progress. This produced a gait with no spring from the right foot, resulting in a marked limp.

The X-rays were difficult to interpret. The lateral view showed a flattened, longitudinal arch. The astragalus was in normal relation to the tibia but the lower border could not be made out clearly and the whole bone appeared to have sunk down-

Fig. 2. Case 2. Foot before (left) and after (right) astragalectomy.

ward in relation to the scaphoid and os calcis. The anteroposterior view showed the head of the astragalus dislocated inward from the scaphoid and the os calcis dislocated outward from the astragalus. The fibula showed evidence of an old fracture about 2 inches above its tip. There was also considerable arthritic change in the joints of the tarsus. Operative removal of a portion of the astragalus to correct the faulty weight-bearing was advised. A small superficial abscess developed on the dorsum of the foot and operation was delayed until it had healed.

September 27, 1921. Operation. Total astragalectomy. An incision was made over the projection on the inner side of the foot. This bony projection was found to be the head of the astragalus. The tendon of the tibialis anticus muscle lay across the neck of the bone, which was in the normal relation to the tibia and fibula. The entire astragalus was removed intact. The ligaments in the region were examined but it was impossible to determine which had been ruptured by the injury.

After removal of the astragalus the eversion and abduction of the foot were easily corrected. As noted in the examination, the external malleolus was farther forward on the foot than normal, and this made backward displacement of the foot on the tibia very easy. This placed the foot in a stable weight-bearing position. The position was maintained by a kangaroo tendon suture through the internal malleolus and the scaphoid. The wound was closed in layers and a cast was applied holding the foot inverted and in slight equinus.

The astragalus was carefully examined after removal, but no evidence of old fracture was found.

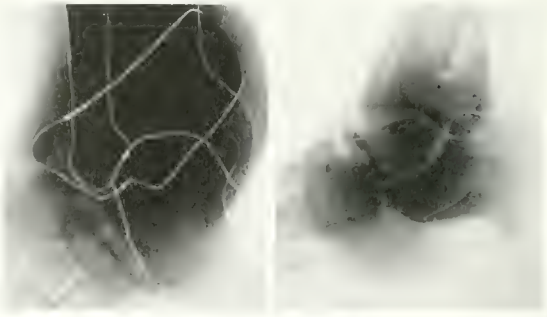

Fig. 3. Case 2. Roentgenograms of foot showing dislocation.

The cartilage covering the head of the bone had been almost completely absorbed.

The cast was removed in 7 weeks and a shoe built up on the inner side, to maintain the corrected position, was used. Weight-bearing was gradually begun.

Three months after the operation the patient was walking, with a cane usually, though he could walk short distances without it. He had no pain. The eversion and abduction of the foot were corrected so that the weight was borne in the normal line. There was about 20 degrees of motion at the ankle though the foot could not be dorsi-flexed quite to a right angle. His gait was much improved, as there was much more spring from the foot. At first he rotated the whole leg outward as had been his habit before the operation, but when his attention was called to this he corrected it voluntarily, with considerable improvement in his walking. He was then working as a hotel clerk.

Case 3. B. T. D., age 52, telephone repairman. Injury received about 30 years ago, as follows: While helping to set a telephone pole it slipped so that the greater part of the weight was thrown suddenly on the cant hook he was using. It struck his left ankle violently on the outer side so that his foot was twisted outward. An attempt was made to reduce the deformity but it was only partially successful. He was disabled for some time but gradually resumed walking and work. The deformity increased gradually for some time after he began bearing weight on the foot, but in general it caused him very little trouble. He has taken on considerable weight the past few years and states that the foot becomes quite tired and aches a good deal especially after carrying more than the usual amount of weight.

Examination shows the foot moderately everted and abducted and the sole much flattened. There is a moderate projection of the head of the astragalus on the inner side of the foot. Both the external and internal malleoli are lowered, i.e., are nearer the sole than normally. The foot just below the malleoli is much broadened. The inner surface of the heel is inclined toward the horizontal. Dorsi- and plantar flexion of the foot are both normal, but the lateral motions are much limited. Motion

at the midtarsal joint is slight. The patient walks with the foot pronated and abducted and there is a slight limp. Since the foot was functioning so satisfactorily to the patient no operative treatment was advised.

X-ray findings. The lateral view shows marked flattening of the longitudinal arch with lowering of the astragalus so that its lower border is below the upper border of the os calcis. There is considerable arthritic change of the joints of the foot.

The anteroposterior view shows the os calcis displaced outward and lying almost parallel to the astragalus. There is some separation of the joint between the scaphoid and cuneiform bones. There is some evidence of a fracture of the anterior portion of the os calcis. The anteroposterior view of the ankle shows the os calcis at almost the same level as the astragalus and to its outer side. The astragalus is in normal relation to the tibia.

os calcis.

In all three of these patients the same primary cause was active, that is, a violent wrenching of the foot outward by a force applied from above. In all of them the foot was probably at nearly a right angle to the leg at the moment of injury. This bears out the experimental work of Baumgartner and Huguier on the cadaver. They found that the dislocation could be produced only by pure abduction of the foot, that is, with the foot at right angles to the leg. They also found that it was necessary to cut the interosseus ligament between the os calcis and astragalus before the lesion could be produced experimentally. If this was not done, fracture of the malleoli resulted.

In the second case the position of the foot at the time of injury was known with reasonable exactness. In the squatting position the foot is at a right angle or less with the leg and is either slightly everted or inverted, depending on whether the weight is borne more on the inner or outer side of the foot. A heavy weight striking the thigh will cause a backward and downward thrust of the tibia, which will cause dorsi-flexion of the foot. In this patient it resulted in a subastragaloid dislocation of the foot outward. It is interesting to note that Stimson describes a case in which injury was produced in almost identical fashion, yet in his case it was a Pott's fracture which resulted.

In the third case the foot was also probably at very nearly a right angle at the time of injury. I have seen recently a case in which the mode of injury was very similar, that is, a blow by a heavy weight falling on the outer side of the ankle while the patient was in the lifting position, in which a fracture of the lower end of the fibula and a crushed fracture of the astragalus were the result.

It seems fair to say that there is no cause which will constantly produce subastragaloid dislocation, but that it is an alternative injury with abduction and adduction fractures in the region of the ankle joint.

The reason for the great preponderance of fractures over dislocations in this region is to be found in the structure of the joints. They are formed by such powerful ligaments that it is easier to produce fracture of the bones than the ligamentous tear necessary for dislocation. Both of the old cases reported give a history of increase of the deformity after weight-bearing was begun. When we consider that, in order to produce a subastragaloid dislocation outward, the interosseus ligament between the astragalus and os calcis, the astragalo-calcaneous ligament, and a portion of the deltoid ligament must be torn, thus depriving the posterior portion of the foot of its most important support, this seems a necessary consequence. In addition to the loss of support the weight bearing line is shifted outward, and this increases the need for support.

In this connection the X-ray findings are of interest. In Case 1, which was recent, there is a marked dislocation of the head of the astragalus from the scaphoid and a separation of the os calcis and astragalus with comparatively little dislocation between them. In the two long-standing cases, the astragalus has

sunk markedly downward as the result of weight-bearing. The other points of interest in the X-rays are the relations of the axes of the astragalus and os calcis. In all the cases the longitudinal axes cross instead of being practically parallel as is normal. In the first and third cases this crossing is at an acute angle, about 20 degrees, while in the second it is at a much greater angle, about 50 degrees.

The two old cases also show a slight separation of the scaphoid from the cuboid and cuneiform bones, though not enough to be an actual dislocation. Quénu noted this finding in a case report in 1918. It is probably a constant finding. Most of the cases in the literature were reported before the X-ray came into use, so that minor associated injuries would easily escape notice.

Both of these cases also show marked arthritic changes especially in the joints involved in the dislocation. These changes may depend in part on injury to the periosteum at the time of the original injury.

TREATMENT

Primary reduction is most desirable and gives excellent results. The method of reduction depends on the variety of the dislocation, and utilizes the underlying principle of the reversal of the force causing the dislocation.

Irreducibility is not infrequently a complication mentioned in the case reports in the literature. The causes given are: (1) Interposition of a portion of the annular ligament between the scaphoid and the head of the astragalus. (2) Engagement of the neck of the astragalus by the tendon of the anterior tibialis muscle or in extreme cases by the tendon of the posterior tibialis. Quénu lays stress on the first cause, while Baumgartner and Huguier emphasize the second. Either condition would call for open reduction.

For old dislocations, astragalectomy is the method of choice. Quénu advocates it for all over 9 days old. This seems rather radical as the first case reported was not reduced until 2 weeks after the injury, and yet no great difficulty was encountered and the result was good. One case is reported in the literature in which closed reduction was accomplished 6 months after the injury. This was in the pre-antiseptic period and at the present time probably would have been operated on.

Baumgartner and Huguier collected the results of 23 astragalectomies for old, irreducible, and compound subastragaloid dislocations. Of these, 13 gave good function, 6 resulted in ankylosis, 1 required secondary amputation, and 2 resulted in death from sepsis. These cases included those operated on in the pre-antiseptic period. Since their report, Thienhaus and Quénu have each reported an old case treated by astragalectomy, with excellent results.

SUMMARY

Subastragaloid dislocation of the foot is a rare injury, alternative with abduction and adduction fractures in the region of the ankle.

The physical signs of subastragaloid dislocation outward are, eversion and abduction of the foot, with prominence of the head of the astragalus on the inner side of the foot. In old cases there is lowering of the malleoli and thickening of the foot below the malleoli.

Treatment in recent cases is reduction, either open or closed as may be indicated. Total astragalectomy gives good results in old cases.

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DEPARTMENT OF TECHNIQUE

FRACTURES OF BOTH BONES OF THE FOREARM WITH GREAT DISLOCATION TREATED WITH PIN TRACTION

BY DR. R. A. KOOPMANS, [illegible]

THE conservative treatment of fractures of bones of the forearm when the fragments are in bad position usually gives unsatisfactory results. To obtain a correct anatomical result and especially to restore function, it is of great importance in these cases more than in fractures of other bones that the fractured bones be brought into good position. Even when a good position of the fragments is obtained, the end result may be disappointing because of excessive callus formation or because the fragments do not unite.

The closed method of reducing a fracture, even with the patient under general anæsthesia, is extraordinarily difficult and sometimes impossible. The ambulatory treatment, with extension splints, as recommended by Bardenheuer, Helferich, Heusner, Hey Groves, and others, fails in many cases, and permanent traction by means of adhesive plaster, applied with bed rest, does not always reduce the dislocation. Steinmann, Wilms, and Schmerz recommended direct traction on the broken bones to obtain reduction. But these methods do not give satisfactory results and many surgeons have decided that open reduction is the best method of treating fractures of the forearm with marked overriding of the fragments. This operation has technical difficulties and risks; and the fixation in plaster necessary to secure immobilization of the forearm promotes stiffening of the joints and hinders functional recovery. It seemed advisable, therefore, to seek a more simple method of treatment and we wish to recommend the technique described below—a distinct traction dressing with pin extension, as recommended by professor Dr. W. Noordenbos.

Two pointed steel pins are used. One, approximately 17 centimeters long and [illegible] millimeters thick, is introduced just above the radio-ulnar joint through the ulna and then through the larger radius; the other pin of the same diameter but shorter is inserted just below the olecranon through the ulna only. The pins are best introduced under general anæsthesia; and, if aseptic precautions be taken, there need be no danger of infection. Traction in opposite directions is exerted on each pin.

The patient is put to bed, and the forearm is held suspended vertically by means of two metal

Fig. 1. Case 2. *a* and *b* show active mobilization of the joints.

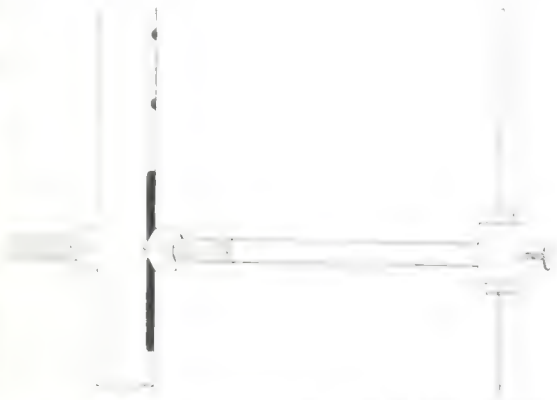


Fig. 2. Diagrammatic sketch of pin and [illegible] used by author in pin traction apparatus.

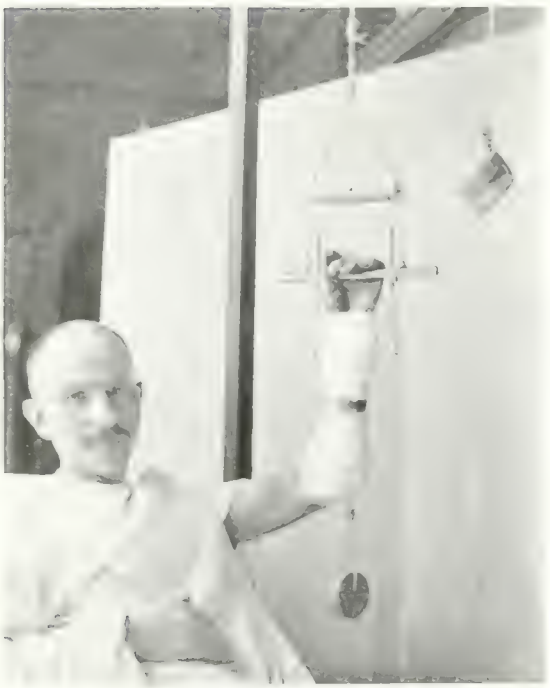


Fig. 3. Case K. K., showing application of apparatus.

wires attached at one end of the longer pin at wrist and at the other end to a cord on the end of which a weight is tied. The upper arm lies horizontally on the bed. The weight cord operates over two pulleys. A cylinder, or handle, is placed between the metal wires at the correct distance. A lesser weight is attached to the shortest pin. The weights vary from 2 to 5 kilograms for the longest pin, and from ½ to 3 kilograms for the shorter, depending on the degree of dislocation and the muscular force. During treatment the fluoroscope is often used to control the position of the fragments. It is very important that the patient be able to move all joints, as this prevents stiffening and muscular atrophy (Figs. 1a and b). If desired, the traction power on one of the broken bones can be amplified by shortening the proper metal wire.

An improvement has been obtained by substituting for the metal wires a simple apparatus as shown in Figure 2, by means of which connection between the pin and the handle is steadier. The pin and the handle with both side bars form a frame which is adjustable lengthwise and sidewise. By removing the screw bolts on one side, the greatest traction power can be exerted on one of the broken bones. And, moreover, the frame can be turned without difficulty, so that the degree of pronation and supination can be modified (Fig. 3).

Though there need be no danger of infection, it is desirable to remove the nails after about 3 or 4 weeks, as otherwise disturbances (by pressure on the bone tissue) may occur. It is easy to remove the nails. To prevent infection, the skin is disinfected, and the end of the pin that must pass the channel is sterilized with a spirit flame.

Eight patients have been treated with this pin-extension method. Successful healing, with prompt bony consolidation and good function, is the rule. A pseudarthrosis was not to be found. In Case 8, with a complicated fracture, consolidation of the ulna was delayed.

When the broken bones are not yet consolidated and the extension apparatus is removed, the treatment must be continued by means of a short plaster splint and massage.

The table shows the length of time consumed in treatment and the end-results.

Case 1. K. K., a fireman, age 29, fell December 25, 1919, a distance of 3 meters, and broke the right upper arm in the middle and the forearm three fingers above the wrist. As the fragments of the forearm bones were in bad position, a traction dressing with two pins was applied January 3, 1920. One pin was placed in position across the ulna and the radius. As the upper arm of the same side was also broken, the second nail was inserted through the humerus just above the condyles. The upper arm was drawn in a

LENGTH OF TIME FOR TREATMENT AND END-RESULTS

Name	Sex	Age	Length of stay in hospital	Duration of the nail-extension	Duration of after-treatment with plaster-splint	Time till consolidation	Time		End Results: Anatomical contour				End Results: Function of forearm			
							Years	Months	Normal	Excellent	Fair	Bad	Normal	Excellent	Fair	Bad
1. K. K.	Male	29	70	21		56	2	1			+		+		+	
2. W. de H.	Male	18	[illegible]	14		21	1	8	+				+			
3. T. B.	Male	[illegible]	[illegible]	22	42	84	1	7			+				++	
4. K. v. K.	Male	37	[illegible]	42	14	84	1	7		++					++	
5. G. de L.	Male	48	41	25		56		11	+				++			
6. A. H.	Male	11	40	21		49		4		++			++			
7. H. B.	Female	48	49	28	17	42		3		++			++			
8. S. de J.	Female	14	75	45	30	168		6½		+						+

Fig. 9.

Fig. 10.

Fig. 8. Case 1, K. K. a. First day.

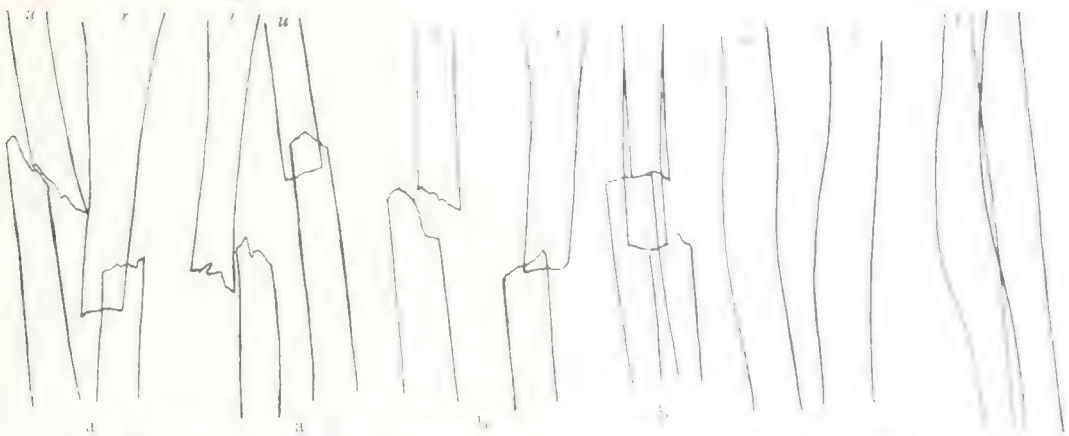


Fig. 11. Case 2, W. deH. a. First day.

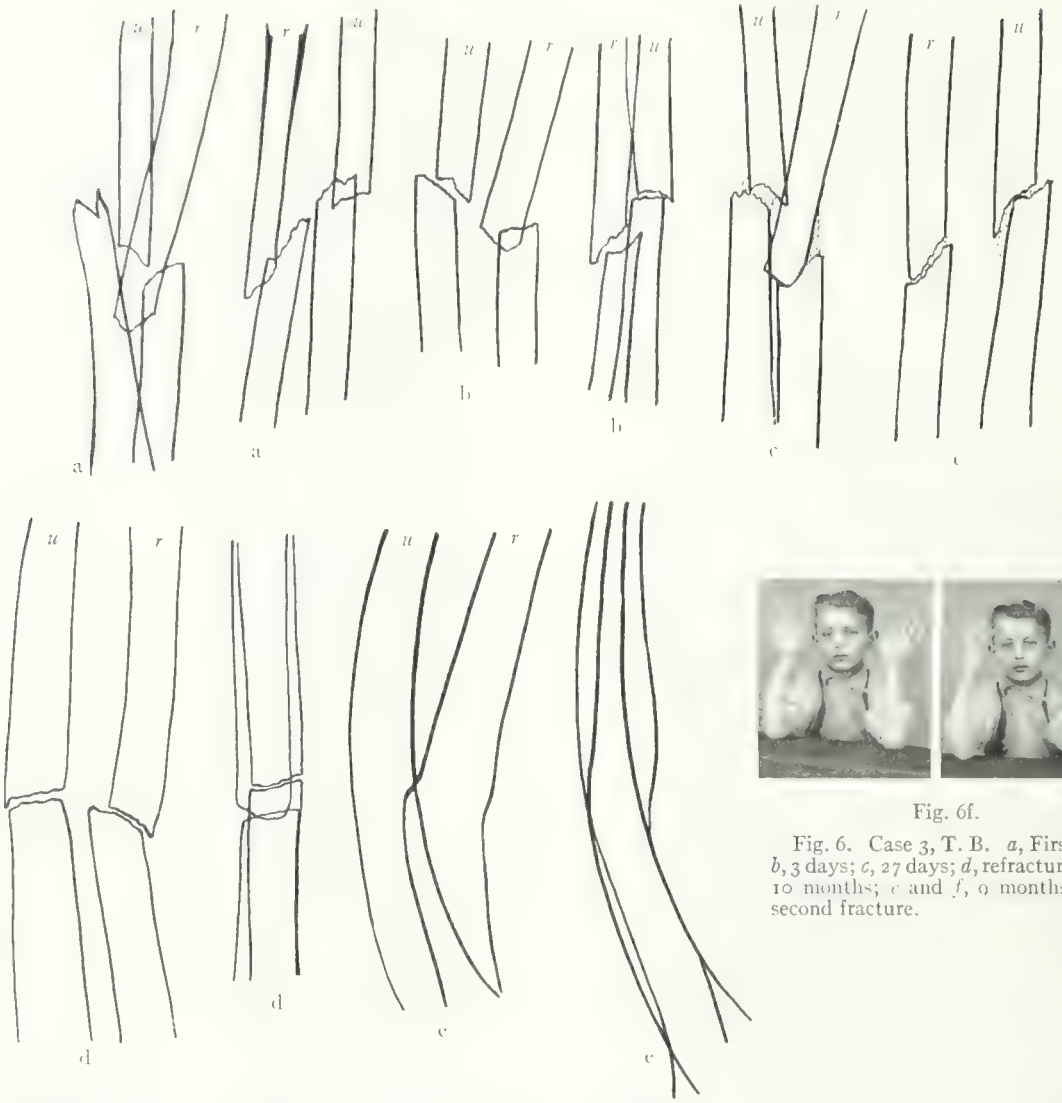


Fig. 6f.

Fig. 6. Case 3, T. B. *a*, First day; *b*, 3 days; *c*, 27 days; *d*, refracture after 10 months; *e* and *f*, 9 months after second fracture.

horizontal line, the forearm in a vertical direction. When the dressing was removed January 23, all fragments were firmly grown together in a rather good position. Although the lower part of the ulna was dislocated, and the dislocation could not be reduced, the patient soon resumed his work. It is still difficult to turn the right forearm. (Fig. 4a, b, c, d, e.)

Case 2. W. deH., a merchant's clerk, age 18, while playing football broke his right forearm, February 19, 1920. The fragments were in bad position, and as closed reduction with the patient under general anæsthesia failed, the pin-traction dressing was applied. Soon a better position was obtained, and when the dressing was removed, March 11, bony consolidation was present. After some months, the patient could make all movements with the right arm. (Fig. 5a, b, c, d.)

Case 3. T. B., a boy, age 8, broke the right forearm March 3, 1920. The position of the fragments was very bad, and the pin-extension apparatus was applied immediately. After 3 days the position was much better. As consolidation had not yet taken place when the dressing was removed, March 25, treatment for 3 weeks was continued with a short plaster splint. In June the functional result was perfect. Unfortunately, January 29, 1921, he broke the right forearm for the second time and at about the same level. Although the dislocation was slight (greenstick fracture) the result of the treatment with the plaster splint was much less satisfactory. At present the forearm is crooked and the supination much impeded. (Fig. 6a, b, c, d, e, f.)

Case 4. K.v. K., a shopmate, age 50, was run over by an automobile March 10, 1920, and the left forearm broken. The pin-traction method was used and on March 25, the position of the fragments was much improved. It was found, however, that the longest pin perforated the radio-ulnar joint. The dressing was removed April 10, and 2

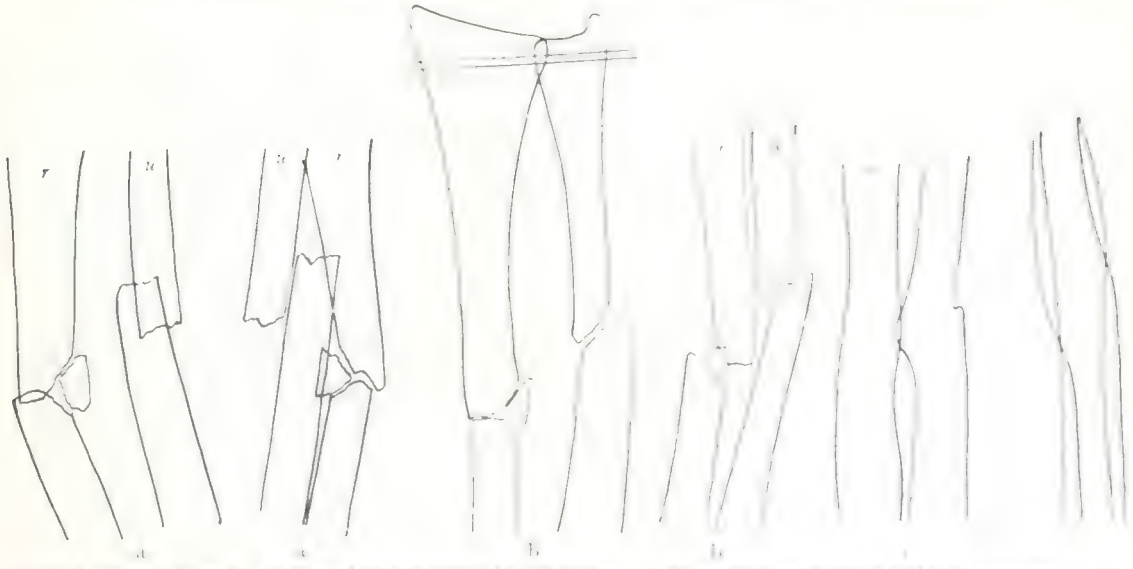


Fig. 7. Case 4, K. v. K. a First day, 1.8 days; b 15 days; c 28 days; d 3 months; e 6 months; f 1 year 9 months.

Fig. 7a.

Fig. 7b.

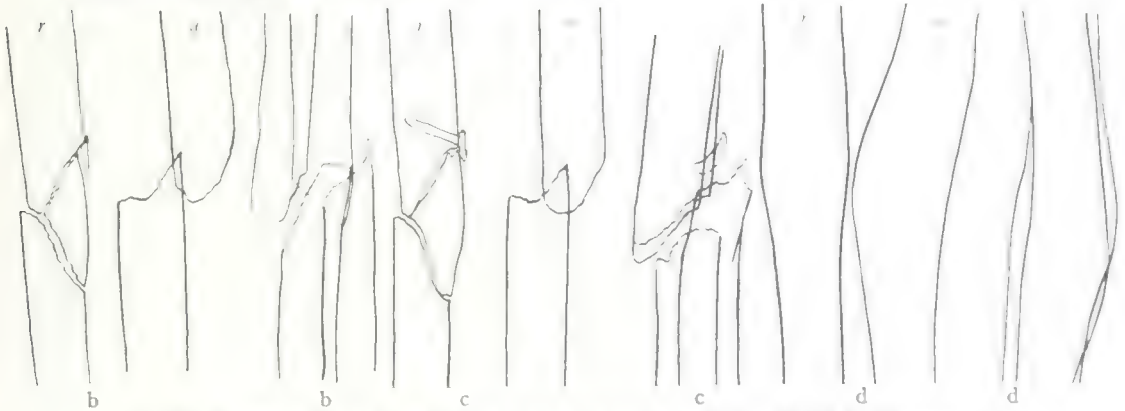


Fig. 8. Case 5, G. de L. a First day, b 10 days; c 14 days, d and e 11 months.

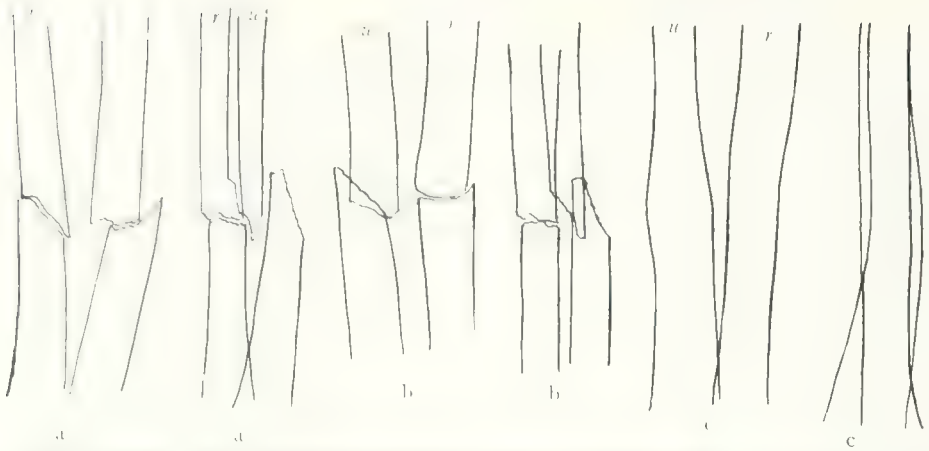


Fig. 9. Case 6, V. H. *a*, 9 days after fracture, one day after second attempt at reduction; *b*, 34 days after fracture, *c* and *d* 4 months after fracture.

Fig. 9d.

Fig. 10d.

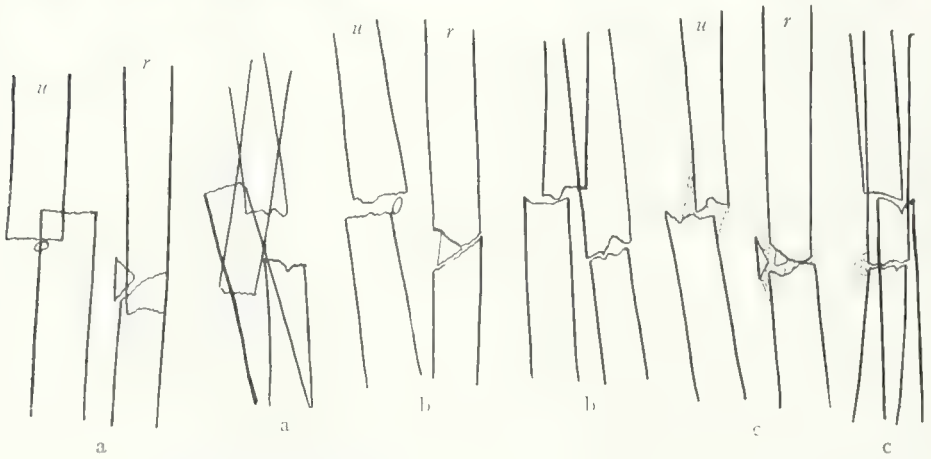


Fig. 10. Case 7, H. B. *a*, First day; *b*, 8 days; *c*, 40 days, consolidation; *d*, 3 months.

weeks afterward the fragments were grown together. Notwithstanding the good position, turning of the left forearm is still always impeded, due largely to perforating of the radio-ulnar joint. (Fig. 7a, b, c, d.)

Case 5. G. deL., a vigorous workman, age 36, came to the hospital, February 21, 1921, suffering with a broken left forearm received in a fight. Two efforts at closed reduction, one under general anæsthesia, failed and February 26 the pin-extension apparatus was applied. The position of the radius was soon corrected and after the greatest traction power was applied for some days to the ulna by removing the screw bolts on this side, the fragments of the ulna also had a satisfactory position. When the apparatus was removed on March 22, the fragments were consolidated and the patient soon resumed his work, with a very good functioning forearm. (Fig. 8 a, b, c, d, e.)

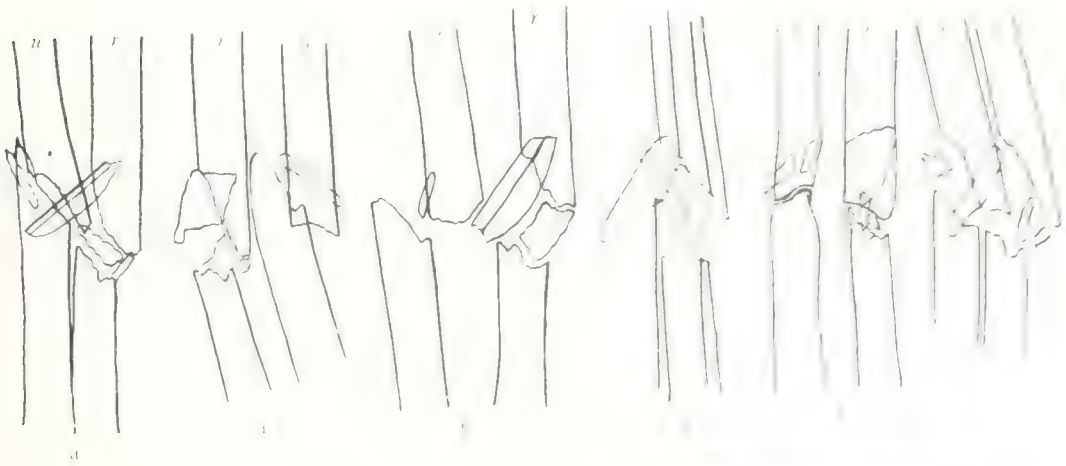


Fig. 11. Case 8. S. deJ. a, b, c, 14 days; d, 48 days; e, 3½ months.

Fig. 11d

Case 6. A. H., a boy, age 11, broke his right forearm, September 16, 1921. Two efforts to reduce the fracture were without success, and September 23 the pin-traction dressing was applied. Soon the position of the fragments was improved, and on removing the apparatus on October 14, consolidation was attained. It lasted a short time, until the turning of the broken forearm could be performed without difficulty. (Fig. 9a, b, c, d.)

Case 7. H. B., a seamstress, age [illegible] and broke the right forearm October 20, 1921. Pin-traction dressing was applied, and soon the fragments were in a better position. The apparatus was removed, November 15, and 2 weeks afterward there was firm consolidation, soon followed by a perfect mobility of the right forearm. (Fig. 10a, b, c, d.)

Case 8. S. deJ., a housemaid, age 19, fell down stairs November 1, 1921, and sustained a complicated comminuted fracture of the right forearm. Fragments of the ulna could be seen in the deep mutilated wound, and the ulnar nerve was severely injured. The pin extension apparatus was applied the next day. For several weeks pus drained from the wound which was dressed daily, but the patient [illegible] radius was consolidated when the apparatus was removed December 7, it was necessary to continue treatment by [illegible] standing the great possibility for pseudarthrosis of the [illegible] It is possible to try the [illegible] but the paralysis of the ulnar nerve has not yet remarkably improved. (Fig. 11a, b, c, d, e.)

CONCLUSIONS

1. In complicated fractures of the forearm, the pin-extension method is to be preferred above other methods of treatment, because dressing of the wound is not impeded.

2. In fractures of the forearm, with overriding of the fragments, this method of treatment deserves commendation, as the results obtained are good; in using this method, an operative reduction can be avoided.

NEW TRACTION AND SUSPENSION BONE TONGS

By EMIL J. HOGLUND, M.D., Chicago

IN non-operable fractures, various types of traction tongs have been used successfully in bringing the fractured bones in good position. However, these instruments have not always brought about the desired result; in fact they have sometimes been the means of producing great deformity and shortening. Lack of success has been due, in my opinion, to the fact that incorrect mechanical principles have been followed in making the tongs. I believe that double tongs such as illustrated will overcome many of the difficulties and prevent failures.

As an example of the application of the tongs, let us consider a comminuted fracture at the lower end of the femur. In such cases we always find more or less contraction of the muscles attached to the lower fragment, producing overlapping of the loose fragments. A straight pull (extension) on the lower fragment usually will bring the lower fragment down but it does not always bring the fragment in alignment with the other fragment. The desired alignment can be secured more easily and positively by means of the suspension and traction tongs; with the four screws it is possible to secure the proper amount of leverage.

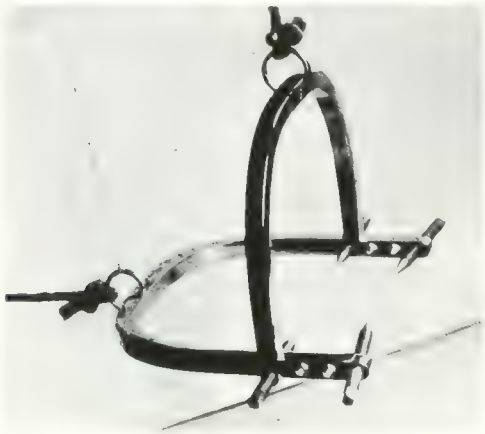


Fig. 1.

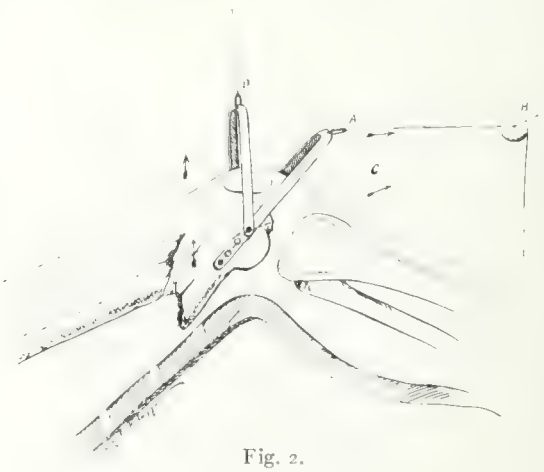


Fig. 2.

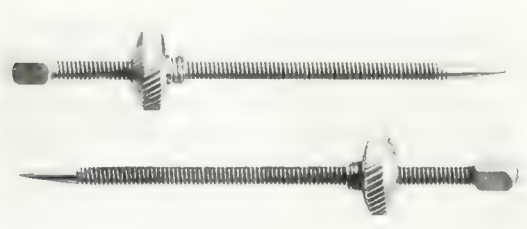


Fig. 3

Figure 1 is a photograph of the tongs and Figure 2 a schematic drawing showing their application in a case of fracture of the femur. The traction tongs with rope to pulley on rod *b* should be set so as to produce sufficient leverage to bring the bones in line, *c*. The suspension tongs with rope *d* are placed in a perpendicular position to act as a pivot. The limb is usually placed in a double incline splint. The screws as shown in Figure 3 are one-half the diameter of the traction screws and are so constructed that they can be pushed through the soft tissues, enabling the operator to feel for the shaft of the bone. When the bone is located the thumb screw is screwed up into the frame of the tongs and the long screws tightened. The modification of the second screws as shown in Figure 3 is not clearly shown in Figure 1.

TRANSSACRAL NERVE BLOCK ANÆSTHESIA IN SURGERY OF THE PELVIC FLOOR AND VISCERA

E. WILLIAM R. MEEKER, M.D.

AND

EMMETT E. FRAZER, M.D.

THE merit of having first called attention to the possibility of block anæsthesia of the sacral nerves belongs to Cathelin. He experimented on dogs, injecting 3 cubic centimeters of a 1 per cent solution of cocaine into the sacral canal, and obtained anæsthesia of the whole body. His attempts to produce anæsthesia in man by this method, however, failed, probably because the drug is so highly toxic that a sufficient quantity could not be injected. The direct result of Cathelin's publication in 1903 was the introduction into France of the epidural method of medicating the nerves of the sacral canal in certain chronic conditions, such as sciatica, neuralgia, lumbago, tabes dorsalis, sexual neuroses, and enuresis.

Stoeckel was the first to employ the newer and less toxic preparations, eucaine and novocaine, in injections into the sacral canal. He gave epidural injections in a series of cases of labor, and published the results in 1909. He injected 30 cubic centimeters of a 0.5 per cent novocaine solution and succeeded in substantially reducing the severity of the pains, but he could not thus establish an operative anæsthesia for any particular area. He called the method sacral anæsthesia.

It was not until 1910 that Laewen succeeded in developing a method practicable for surgical operations which attracted any serious attention. He applied the principle established by Gros, that the efficiency of the novocaine solution could be markedly increased by the addition of bicarbonate of soda, and used larger quantities of more concentrated solutions than those employed by Stoeckel. With the aid of such anæsthesia Laewen was able to perform painlessly the more common operations on the anus, perineum, and female genitalia. He called the method extradural anæsthesia.

Later, Schlimpert and Schneider injected still larger doses of novocaine and attempted to obtain sufficient anæsthesia at higher levels in order to perform lower abdominal operations. This was successful only with the aid of larger quantities of the preliminary narcotic drugs sufficient to produce semisomnolence. In this method of high extradural anæsthesia the actual extent of the block anæsthesia is largely a matter of conjecture, because of the deep preliminary narcosis before operative anæsthesia is produced. It is generally recognized that extensive operations may occasionally be performed under heavy doses of morphine and scopolamine alone, so that in high extradural anæsthesia, the block anæsthesia is often only partial and sometimes entirely superfluous. Moreover, the concomitant symptoms of high extradural anæsthesia are often quite severe, consisting of giddiness, nausea, vomiting, and even collapse. Epileptiform seizures, following high sacral anæsthesia, have been reported in twelve cases by four surgeons. Wiedkopf's collected list of fourteen fatalities for which local anæsthesia may have been responsible, included nine cases of high sacral anæsthesia. The extreme vascularity of the epidural space provides a huge surface for absorption and the high pressure occasionally necessary to force the solution into the sacral canal certainly must increase the rate of absorption. In many toxic cases reported it is mentioned that blood dripped from the needle, indicating its probable insertion into a blood vessel. While high sacral anæsthesia is still occasionally employed in abdominal operations, the present tendency, following the leadership of such authorities as Denk, Laewen, Bleek, Pauchet, and Zweifel is to use extradural anæsthesia to block off the sacral nerves only.

Low sacral anæsthesia has been rather extensively employed, and, in the opinion of those who have developed it, only needs to be better known in order to be more widely and usefully practiced. Other formulæ besides the novocaine-bicarbonate solution of Laewen and Gros have been introduced, and another term, caudal anæsthesia, proposed for the procedure. Thus, four terms, epidural, sacral, extradural, and caudal anæsthesia apply to the same procedure. In the preparation of the solution, Strauss adds sodium sulphate which he claims prevents the decomposition of epinephrin. Harris maintains that the efficiency of the solution is increased by the addition of calcium chloride; potassium sulphate has been employed

Fig. 1. Position of patient and operator for the induction of parasacral or presacral anæsthesia. (Modified from Pauchet.)

for this purpose, and Allen uses a 5 per cent solution of gelatin to delay absorption from the site of injection. Hertzler recommends the use of larger amounts of weaker solutions, and Maxeiner uses up to 4 ounces of 0.5 per cent solution in anæsthesia of the bladder. Clinical experience indicates more favorable results with larger amounts of weaker solutions and a somewhat longer period for the onset of anæsthesia.

In spite of the increasing popularity of the method, and of many attempts to improve it, a serious disadvantage persists, namely, failure in a fairly high percentage of cases. The proportion of failures varies markedly in the hands of different operators. The highest incidence of failures, 45 per cent, is recorded by Babcock. The best results are those of Pickens, who, in a series of 100 cases, admits seventeen failures. Fischer reports twenty-one failures in 155 cases of high sacral anæsthesia, but very deep preliminary narcosis was used. Any method of anæsthesia which has 15 per cent of failures after a waiting period of 20 to 30 minutes cannot become universally popular, but if some means can be devised which will bring about a practically certain operative anæsthesia, the method will meet with more general employment. Its chief use at present, outside of minor surgery of the terminal rectum and perineum, is probably in urologic manipulations (16, 41) and in obstetrics (12).

Even when anæsthesia appears, the height is variable, extending from the anal margin in light anæsthesia to complete motor paralysis of the legs in others. The region anæsthetized is, therefore, not constant for all cases and often a far greater area is anæsthetized than is required for the operative work.

Besides the variable height of anæsthesia, another drawback is the appearance of toxic symptoms. These are not, as a rule, severe, provided the injection is properly carried out and the solutions used are not too concentrated. These symptoms, which are transient and of no consequence, consist of acceleration of the pulse, palpitation, sweating, dizziness, and sometimes nausea. Vomiting and sometimes even collapse may occur. Hirschel has observed slight collapse in several cases and severe collapse in one. Scholl reports two cases of collapse of short intervals and one of transient psychosis during the correct injection of doses of novocaine as recommended by Laewen.

For operations on the female genitalia and for confinements Ilmer has recommended that the pudic nerve be blocked on both sides on the medial surface of the inferior rami of the os ischii. This procedure in the hands of Braun, Pauchet, Labat, and others has given poor results. The method seems not to be based on practical experience, as no extensive operative anæsthesia results, even though both pudic nerves are properly blocked. Anatomical relations make blocking of this nerve a difficult procedure, because on the inner surface of the pelvis it is covered by obturator fascia, and it divides before its entrance into the ischiorectal fossa. For the latter reason Franke and Posner attempted to block this nerve on the outer surface of the spine the ischium. With a finger in the rectum the needle is advanced to the ischial spine. The direction is then changed backward to the outer surface of the bone. Blocking the pudic nerve by this method was never widely attempted because of the technical difficulty and uncertainty of results. Even when blocking is successful, only scant operative anæsthesia is produced unless the coccygeal plexus, superficial perineal rami, and posterior cutaneous femoral nerves are also blocked.

A more dependable anæsthesia by a simpler method may be obtained by blocking the sacral nerves at their points of emergence from the anterior sacral foramina. This method is accredited to Braun. He calls the method parasacral anæsthesia, following Sellheim and Laewen's term for paravertebral anæsthesia, in which the nerves are injected as they leave the spinal canal. With the patient in the lithotomy position (Fig. 1), two points of injection 1.5 to 2 centimeters from the median line at the level of the sacrococcygeal articulation are selected, and dermal wheals

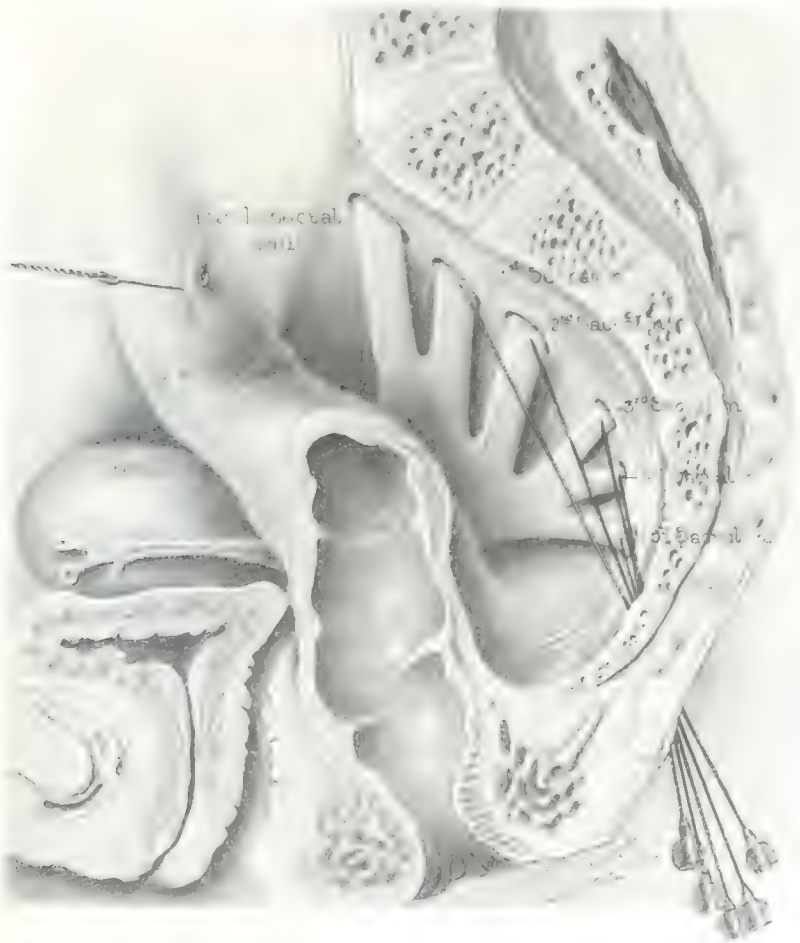


Fig. 2. Parasacral or presacral anæsthesia. Median section shows pelvic viscera displaced far forward. Normally the rectum, even when empty, [illegible]

raised. A longer needle is then introduced and the way is felt past the edge of the sacrum and along the anterior surface of the bone parallel to the median line to the height of the second sacral foramen (Fig. 2). This entire distance is injected with 20 cubic centimeters of 1 per cent novocaine solution. The needle is then drawn back to the edge and is directed at a small angle more anteriorly toward the line of the innominate bone, still parallel to the median plane. The needle is then advanced much deeper than before until it strikes the promontory of the sacrum close to the first sacral foramen where 20 cubic centimeters of solution is injected. The procedure is repeated on the opposite side, after which a final injection of 5 cubic centimeters is made between the coccyx and rectum, 100 cubic centimeters in all being used. More recently 0.5 per cent solu

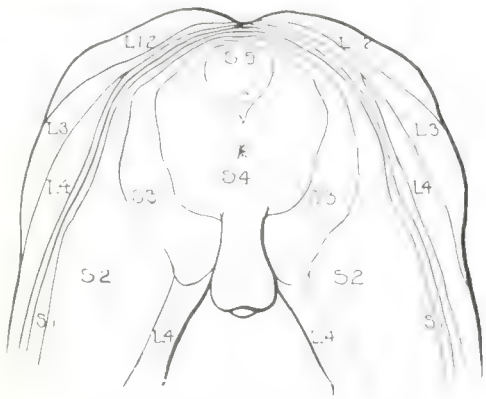


Fig. 3. Sensory innervation of the perineum showing needlessness of infiltrating the perineum for overlapping cutaneous fibers when all sacral nerves are properly blocked [illegible]

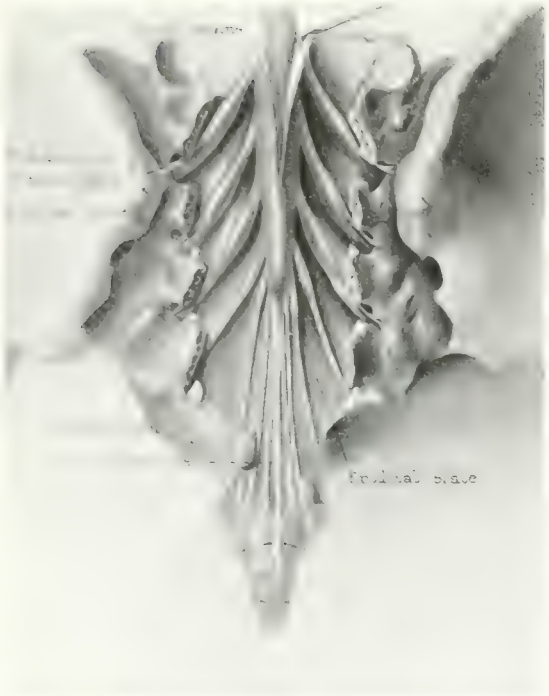


Fig. 4.—Sacral portion of spinal meninges and sacral nerves in the epidural cavity, after removal of the fat, connective tissue and venous plexus normally filling this space. The sacral laminæ have been entirely removed. Note the comparative sizes of the sacral nerves and the greater proximity of the fifth sacral nerve to the median line. (After Spalteholz.)

tion has given better results, 100 cubic centimeters usually being injected on each side. Braun makes the injections without the aid of a guiding finger in the rectum, but other operators usually determine the position of the needle in this manner.

Braun has found parasacral anæsthesia more reliable than the sacral method. Its use has by no means been as widely adopted, partly because of the greater difficulty in the performance of parasacral nerve block and the consequently undependable results. In the hands of Farr, this method gives incomplete anæsthesia in about 10 per cent of cases.

While anæsthesia would be certain with accurate perineural injections for each sacral nerve trunk, such a high degree of anatomical accuracy is rarely attained, unless paræsthesia is provoked from contact of the needle point with each nerve trunk before injection. Multiple paræsthesias are very disturbing to the patient, and for this reason should be avoided so far as possible. The secret of success seems to lie in keeping the needle parallel to the median plane anteroposteriorly and maintaining constant contact with the sacral concavity.

Probably the best results obtained in any series of cases operated on under parasacral anæsthesia are those of Tolken. This series of cases is especially interesting because the preliminary narcosis was light, never being sufficient to smooth over an otherwise imperfect nerve block anæsthesia. In none of his forty-three cases was a general anæsthetic necessary, although in two instances there was considerable pain at operation. He usually infiltrated the tissues locally at the line of incision and so there may have been other cases in which anæsthesia from the parasacral injections alone was incomplete. Haertel recommends superficial infiltration of the tissues of the outer margin of the perineum in order to anæsthetize overlapping cutaneous fibers. In our experience, however, if all sacral nerves are properly blocked, cutaneous anæsthesia extends as far as the upper medial surface of the thighs (Fig. 3). In vaginal operations Haertel also combines the parasacral method with deep and superficial fanwise injections posterior to the vulva; the latter method in the hands of Hertzler was alone sufficient for perineorrhaphy. Franz combines spinal anæsthesia and the parasacral method in resection of the carcinomatous rectum, when the duration of the spinal anæsthesia is not sufficient for the conclusion of the operation.

The passage of needles through the perineum according to the parasacral or presacral method is not without an element of local danger. The rectum, even when entirely empty, fills the concavity of the sacrum, and when bound down or partially fixed by pelvic adhesions, or displaced by pressure from neighboring structures, the risk of perforation cannot be denied. Infection may also be spread by the needle punctures when a septic area is traversed. Similarly, the possible dissemination of cancer cells from secondarily involved perirectal lymph glands in cancer of the rectum must be kept in mind.

In 1913, Danis proposed a method of blocking the sacral nerves through the posterior sacral foramina and named the technique transsacral anæsthesia. In the opinion of many operators, Danis' method has overcome many of the inconveniences and disadvantages of parasacral and sacral anæsthesia. However, it was never adopted by the Germans, nor is any mention of the method made by Braun or Haertel. In the hands of Pauchet and his associates, this method has gained much favor, and Olivieri of Buenos Aires regards it as the method of choice in surgery of the perineum. In the Mayo Clinic transsacral

with the sacrococcygeal or obturator membrane.

nerve block has given such satisfactory results that a detailed description of the technique with a report of 225 conservative operations by this method seems to be merited.

ANATOMICAL CONSIDERATIONS

In the present consideration of transsacral nerve block, the most important anatomical features of the sacrum are the canal and its contents and the topography of its posterior aspect. The sacral canal is a continuation of the spinal canal and is enclosed by the bony walls of the sacrum, except at its lower end where it terminates in the hiatus sacralis. The canal is triangular above and relatively large, growing smaller and flattened below. It follows the forward curvature of the sacrum which is variable in different persons and in the sexes. It contains the dural sac, which usually ends at the lower border of the second sacral segment. Within the dural sac the nerves of the cauda equina are bathed in spinal fluid (Fig. 4). As each pair of nerve roots of the cauda equina passes outward, the nerves lie free for a variable distance in a tubular extension of the dura before the latter blends with and contributes to the thickness of their sheaths. As the nerve trunk reaches the sacral foramen, the contribution of the dura to the perineural sheath is no longer evident.

In the sacrum the dura is not attached to the periosteum, as in some other localities, except by the downward continuation, the filum terminale, at the lower end of the sacrum. The space between the dura and the periosteal lining of the canal is called the epidural cavity and is filled with delicate fat, areolar connective tissue, lymphatics, and venous plexus.

The lower end of the sacrum presents a triangular opening on its posterior aspect, the hiatus sacralis, giving entrance to the sacral canal (Fig. 5). The extremities of the base of this triangle are marked by the two sacral cornua, which represent an undeveloped fifth spinous process. The apex of the triangle is designated by the termination of the crista sacralis, the fourth sacral spine. The hiatus is covered over by the posterior sacrococcygeal ligament or obturator membrane. The size of the sacral hiatus varies greatly, according to the degree of closure of the posterior arches of the sacral segments and amount of ossification of the obturator membrane.

The four posterior sacral foramina lie between sacral segments and give passage to the upper four pairs of sacral nerves. The fifth sacral nerve passes through the sacral hiatus, runs laterally below the sacral cornua, and lies in the sacral notch below the fifth segment. This bony notch with the aid of the lateral sacrococcygeal ligament forms a fifth foramen. These foramina lie in the same straight lines on either side of the crista sacralis, are oval or circular in shape, and covered over by ligamentous structures. They traverse the sacrum anteroposteriorly and almost perpendicularly to the tangent of the sacrum (Fig. 11); they are very nearly equidistant from each other, the distance between foramina decreasing somewhat from above downward. A line connecting the most prominent points of the posterior superior iliac spines lies between the first and second foramina, but nearer the second.

Fig. 6. Position of patient and operator for induction of transsacral anæsthesia. Note the method of holding the needle and inclination in searching for foramina at that level.

TECHNIQUE

The patient is placed in the ventral decubitus position with a cushion under his hips (Fig. 6). This elevates the buttocks, partially flexes the hips and serves to accentuate the bony landmarks. The horizontal position also promotes a more favorable diffusion of the fluid, for if gravity exerts an influence in causing fluid to escape through the anterior sacral foramina, it will continue to bathe the sacral nerves on the anterior aspect of the bone.

The cutaneous area around the sacrum and over the buttocks is sterilized in the same manner as for a laparotomy. It is first cleaned with benzene, and then painted with tincture of iodine which is removed with alcohol.

With the index finger of the left hand the tip of the coccyx is palpated in the anal groove. The finger then follows the posterior surface of the coccyx upward until the two sacral cornua are felt on either side. The cornua are the most prominent lateral tubercles encountered and are almost always definitely palpable. Location of the sacrococcygeal joint, by movement of the coccyx with a finger in the rectum (36), is useless and troublesome when such reliable landmarks as the sacral cornua are available. Somewhat higher in the median line the finger identifies the fourth sacral spine, indicating the apex of the triangle guarding the entrance to the canal. The obturator membrane forms a depression within these three points, and often gives the examining finger a sensation which has been compared to that produced by palpating a fontanelle. With the finest hypodermic needle a dermal wheal is raised in the center of the sacral hiatus and the underlying subcutaneous tissues and the obturator membrane are infiltrated so that the passage of the larger needle will not cause pain. A spinal puncture needle of small caliber is then introduced through the skin with the bevel upward and at an angle of about 20 to 30 degrees with the skin surface (Fig. 7). There is a sensation of increased resistance as the sacrococcygeal ligament is reached, and when this is perforated the point of the needle impinges against the bone of the anterior wall. Whenever the needle is felt to pierce a dense membrane, pass through a free space, then come in contact with bone, there is no doubt but that the sacral canal has been entered. The needle is then withdrawn 1 or 2 millimeters and depressed about 20 degrees farther until approximately parallel to the sacral canal. It is then advanced gently and slowly about 3 or 4 centimeters into the canal, and usually passes readily. If bony resistance is encountered, the needle should be rotated, depressed at its base, and either raised or lowered at the shoulder, being thus gently manipulated until the bony resistance is passed. The stylet is then withdrawn leaving the needle in place. If blood or spinal fluid escapes it has entered one of the large veins or the dural sac, and it should be slightly withdrawn or its position changed until the blood or spinal fluid ceases to appear. The syringe is then connected and the injection made very slowly and gently. The needle is withdrawn as the injection progresses until 20 to 30 cubic centimeters of the novocaine solution has been injected, when the tip of the needle is just inside the obturator membrane.

The crest of the ilium is then palpated and followed posteriorly until the posterior superior spine is located (Fig. 8). The most prominent point of this spine is then determined and a dermal wheal made about 1.5 to 2 centimeters inward and about 1 centimeter downward (25). This point should lie above the second sacral foramen. Another wheal is made just below and lateral to the sacral cornu which locates the fifth foramen. The distance between these foramina is then divided into three equal parts by two more dermal wheals, which mark the position of the third and fourth foramina. Another wheal is then placed in line with these four and above the first, usually about 2 to 2.5 centimeters, for the location of the first sacral foramen.

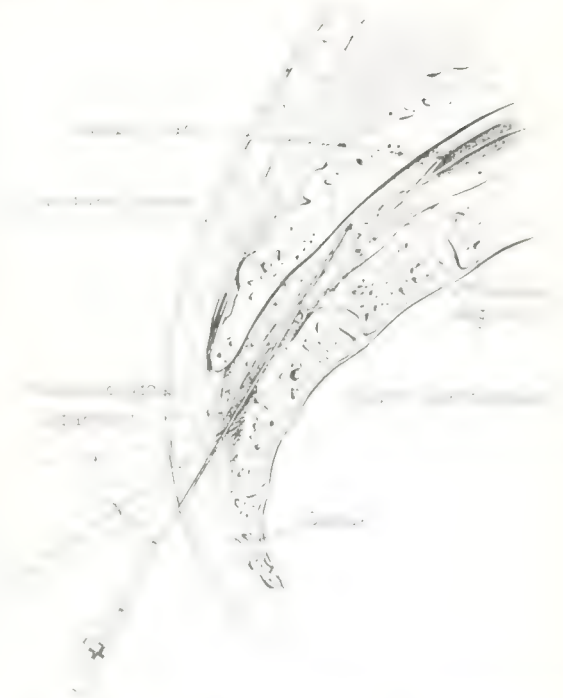
The thickness of the soft tissues overlying the sacrum is much greater above and decreases downward, which necessitates the employment of

needles of different length in searching for the various foramina (Fig. 9). Less discomfort is given the patient when the smallest needle possible is employed in probing for a given foramen.

With an 8-centimeter needle the anæsthetized skin is perforated over the second foramen. The needle is then inclined somewhat downward until it is thought to be perpendicular to the tangent of the sacrum at that point, and slightly inward. It is then gently advanced until it either comes in contact with bone or passes through the foramen. If it comes in contact with the bone, it is gently withdrawn and another search for the foramen is made. In this way, the distance from the skin to the periosteum is estimated and when, after repeated attempts, the needle seems to perforate a membrane, advance farther than before, and still not encounter bony resistance, it has passed into the foramen. It is unusual to insert the needle directly into the foramen at the first attempt. If this does occur, it is probably better to withdraw the needle, direct it somewhat more obliquely and locate the margin of the bone more superficially. It is thus verified that the first position was correct, and it only remains to reinsert the needle in the original location.

The needle in the foramen is usually left in place to serve as a guide while search is made for the third foramen. A 5-centimeter needle is employed for the three lower foramina. After injecting the third and fourth foramina the 10-centimeter needle is inserted into the first foramen. This foramen lies deepest of all and prolonged search is often necessary for its location. In order that the needle may advance perpendicular to the plane of the sacrum, it must be inclined more to the skin surface than in the other foramina. After the upper four foramina have been injected, those of the other side are located and injected in the same manner. When both sides have been injected the skin over the coccyx is tested for anæsthesia with a clamp. If it is insensible to pain, the fifth sacral foramina are not injected; otherwise, they are injected in the manner already described.

In transsacral anæsthesia, more than in any other nerve block technique, it is necessary to have a mental picture of the topographic anatomy of the region. It requires practice and patience for mastery and may seem difficult to acquire and to execute (11), if the operator is unable to visualize the framework through the soft overlying structures. Faulty technique may rapidly be improved by practice on the human skeleton and cadaver. It is important to remember that the sacrum is greatly curved toward its base so that



Longitudinal median section of the lower sacrum

in searching for the higher foramina, the thickness of the overlying soft tissues is much greater. The needle should always be advanced perpendicularly to the tangent of the sacrum at the foramen under consideration, which means that there will be the greatest obliquity to the surface of the skin in searching for the first foramen, less for the second, and scarcely any at all in the three lower foramina. Lateral inclination of the needle should be guarded against, as after osseous contact the needle may be directed more laterally and pass entirely off of the sacrum (Fig. 10). Location of the foramina by means of a system of lines and measurements as practiced by Pauchet and Sherwood-Dunn, we have found to be impractical and at times, inaccurate. The posterior superior spines and the sacral cornua are the most prominent landmarks even in obese subjects, and calculations based on less definite bony points must be correspondingly less accurate.

Proper precautions must be observed in the preliminary preparation of the patient and in the technique of the nerve block so that the procedure will not be painful. A proper preliminary narcosis of morphine and scopolamine should be given when needed, the amount being determined by

Fig. 8. Transsacral anæsthesia. On the right side note relation of cutaneous points to posterior superior spines and sacral cornu. Soft tissues have been removed on the left exposing the sacral foramina. (Modified from Pauchet.)

the age, weight, and general resistance of the patient. The dose should be sufficient to allay mental apprehension, but not to produce a state of somnolence or "twilight sleep." In many weak, debilitated, bed-ridden patients, no preliminary narcosis at all is used. For the average adult, morphine, 1/6 grain, and scopolamine, 1/300 grain, are given an hour before operation. Frequently in robust individuals of more than average weight this dose must be repeated one-half to one hour after the first administration.

The greatest pain in searching for foramina is caused by making the dermal wheals. This is but transitory and usually well tolerated. In highly sensitive individuals the point of entrance of the needle may first be anæsthetized with ethyl chloride, but this is ordinarily unnecessary. While making the initial stick the thumb should be on the plunger so that at the moment the needle enters the skin the solution can be injected. In this way the puncture is often made without the patient's knowledge. When the needles are sharp and bright there is no further pain, unless the periosteum is roughly probed. Besides causing pain this thrust also bends the point of the needle to a hook so that it tears the tissues when withdrawn and requires more force for penetration. A bent needle should be discarded immediately. Pain is occasionally produced by advancing the needle directly into a nerve trunk. The pain is shooting in character and is radiated through the pelvis to the external genitalia or down the thigh, according to the nerve trunk reached. When this occurs the needle should be withdrawn 1 or 2 millimeters so that a perineural and not an endoneural injection will be made. An endoneural injection of a large nerve trunk with the same amount of solution required for block by diffusion of the solution after perineural injection is more likely to injure the nerve trunk and result in postanæsthetic pain.

The distance for which the needle should be introduced into the foramina varies. The sacrum diminishes in anteroposterior diameter from above downward (Fig. 11). The average length of the first sacral foramen is 2.5 centimeters, the second 2 centimeters, the third 1.5 centimeters, the fourth 0.5 to 0.7 centimeter, and the last 0.3 to 0.5 centimeter. It is desirable to make the injection anterior to the midpoint of the foramina, withdrawing the needle somewhat during the progress of the injection.

The amount and strength of the procaine-epinephrin solution employed varies with the size and general resistance of the patient. For greatly debilitated patients, and for relatively poor surgical risks, a solution of 0.5 per cent strength is used. The amount is then gauged more or less on the probable size of the sacrum. From 20 to 40 cubic centimeters of the solution are injected into the sacral canal, then the sacral foramina are injected according to their size and the size of the nerve trunk to be blocked. The greatest amount should thus be injected into the first foramen and the quantity for each successive foramen reduced by 1 cubic centimeter, that is, 7, 6, 5, 4, and 3 cubic centimeters respectively. From 75 to 140 cubic centimeters of the 0.5 per cent solution has given uniformly complete anæsthesia. When 1 per cent is employed in robust individuals, 20 to 25 cubic centimeters are injected into the sacral canal and the posterior foramina in the same ratio as with 0.5 per cent. From 60 to 110 cubic centimeters of 1 per cent solution have in all cases produced complete physiological block. Ten minims of epinephrin for each 100 cubic centimeters of solution are used in all cases.

TWO HUNDRED TWENTY-FIVE CASES OF TRANSSACRAL NERVE BLOCK ANÆSTHESIA

From November, 1920, to May, 1922, transsacral nerve block anæsthesia has been employed in the Mayo Clinic in 225 consecutive operations on the pelvic floor and its viscera. This series does not include cases in which transsacral block has been used with lumbar paravertebral anæsthesia in resection of carcinoma high in the rectum, in vaginal hysterectomy, or those in which it was combined with abdominal wall field block for suprapubic prostatectomy. In the entire

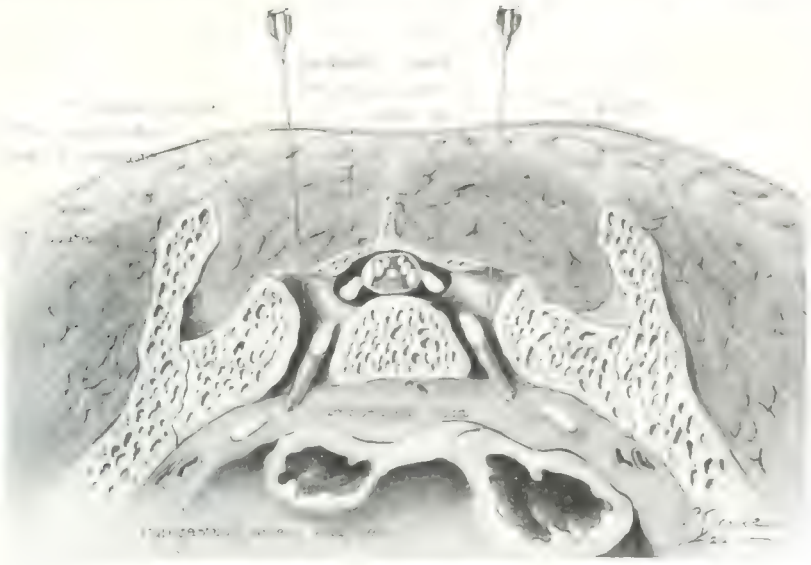


Fig. 9. Oblique cross section through the first sacral foramina (semidiagrammatic). Note slight medial inclination of needles which are in proper position for injections nto the foramina.

series preliminary narcosis was very light, often exerting no noticeable effect. Anæsthesia was complete in 222 cases, while some pain was experienced at operation in three cases, although inhalation narcosis was not resorted to. In these three cases 0.5 per cent solution was employed, which probably was not strong enough.

In the selection of this series of cases no effort has been made to assign one particular type of operation to this method of anæsthesia. During the same interval, many other operations of the type herein represented have been performed under other methods of anæsthesia, and no absolute contra-indications to the use of general narcosis have existed. It is interesting, however, to note some of the relative indications for local anæsthesia. Twenty-one patients had a "cold" on the morning of the operation. Transsacral block was used for the second operation in forty-one patients in the hospital convalescing from laparotomies. Thirty-two patients were given local anæsthesia because of their poor general condition, due to senility, arteriosclerosis, and varying degrees of chronic nephritis and myocarditis. There were two diabetics who were sugar-free at the time of operation. There were five cases of marked anæmia, two of pernicious, and three of severe secondary anæmia; all these patients had had previous transfusions. Six patients were obese women, each weighing more than 200 pounds. The list also includes five patients with clinical pulmonary tuberculosis, in two the condition was diagnosed as active at the time of operation. Only sixteen patients of the series had requested local anæsthesia.

Complications and after-effects have been few and of no serious concern. There were no post-operative pulmonary complications and no deaths in the entire series. Twenty-four patients had to be catheterized after operation (about 8 per cent), and twenty patients had retention catheters inserted at operation. Vomiting did not occur either during or after operation and in most instances the patient was immediately placed on a normal diet. In the more severe cases diet was restored progressively in from one to three days after operation, depending on the general condition of the patient and type of operation performed. Stimulating drinks, such as tea and coffee, may be administered immediately after operation.

Complications referable to the anæsthesia are tenderness over the sacrum and mild toxic symptoms. In about 15 per cent of cases there has been soreness and tenderness over the sacrum for the first two to four days. This was at times so distressing as to cause the patient to lie on his side. No special care, such as applications and dressings or the use of air cushions, has been given the sacral region after anæsthesia. There have been no cases of infection in the sacral region.

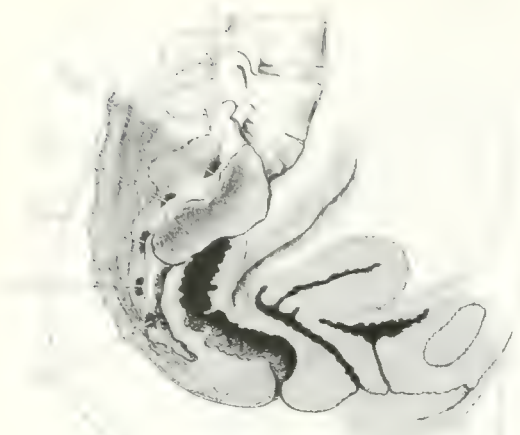


Fig. 10. Median longitudinal section of the pelvis anterior to the sacrum, with the entire sacrum preserved. The shaded portion represents the anæsthetic area, which should also include the medial surface of the thigh and buttock. Note the variable thickness of tissues over the sacrum, and different direction of needles in entering different foramina. (Modified from Pauchet.)

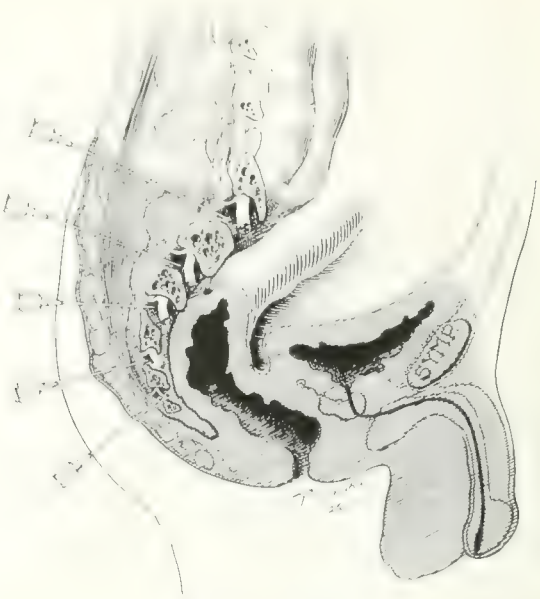


Fig. 11. Median longitudinal section of pelvis anterior to sacrum and oblique longitudinal section through the right sacral foramina. Note progressively decreasing length and diameter of the foramina from above downward and the decreasing size of the nerve trunks. Anæsthetized area of the pelvis is shaded, but as in Figure 10 it should also include the medial surface of the thigh and buttock. (Modified from Pauchet.)

Toxic symptoms when they occur, are mild and of no consequence. They consist of pallor, palpitation, perspiration, and sometimes a feeling of giddiness. When dealing with such mild symptoms it is not always easy to differentiate nervousness and toxicity. There have been no cases of vomiting, rigors, convulsions, syncope, or collapse. One patient, while on the operating table, developed symptoms of fast thready pulse, ashen facies, and cold clammy sweat, but responded to hypodermic stimulation of sparteine, strychnine and caffeine. A laparotomy had been performed two weeks previously, after which he had been unable to be out of bed. It is probable that his extreme weakness and poor general condition may have been important factors in the production of symptoms.

The extent of anæsthesia by block of the sacral nerves is best appreciated by a consideration of the variety of operations that have been painlessly performed under it (Figs. 10 and 11). In surgery of the rectum it has been employed in hæmorrhoidectomy, the usual type of operation being clamp and cautery of internal hæmorrhoids and excision and suture of external hæmorrhoids. Relaxation of the sphincters and muscles of the pelvic diaphragm are features especially favorable to surgery of the terminal rectum. Plastic operations on the anal sphincters, removal of rectal polyps, amputation of the prolapsed rectum, dilatation of rectal strictures, and excision of specimens from rectal tumors for diagnosis have been repeatedly performed under sacral nerve block. It has also been employed in posterior resections of cancer low in the rectum with removal of the coccyx and fifth sacral segment. It is usual in resection of cancers higher in the rectum to block the three lower lumbar nerves as well, although carcinomatous growths 5 centimeters from the anus have been painlessly removed under sacral nerve block alone. Both the single-stage resections with sacral anus and the two-stage resections after preliminary colostomy have been performed (31).

Gynecological operations have included perineorrhaphies, the Bovée operation for cystocele, trachelorrhaphy, dilatation and curettage, removal of cervical polyps, dilatation of the vagina in vaginismus, vaginectomy, excision of vaginal tumors, and removal of cancer of the rectovaginal septum. External urethrotomy and plastic repair of perineal urinary fistula have been performed in the male. The anæsthesia is also sufficient for

perineal prostatectomy, although it has not been employed in this operation at the Clinic. Multiple infected perineal sinuses and postanal pilonidal cysts have been excised and the coccyx removed for coccygodynia. In urology it has been employed for anæsthesia of the bladder, prostate, and urethra after epidural anæsthesia alone has been found insufficient. For more superficial work on the perineum, as hæmorrhoidectomy, anal fissures, plastic work on the anal sphincter, and anal fistula, block of the four lower sacral nerves alone is sufficient. For operations involving deeper structures, as resection of the rectum, vaginectomy, perineorrhaphy, operations on the cervix, and prostatectomy, all five sacral nerves are blocked.

The extent of anæsthesia involves the entire pelvic floor and all structures lying below the pelvic peritoneum. The more dependent part of the pelvic peritoneum is also anæsthetized, so that it may be opened painlessly; but any great pull on it may be transmitted outside of the area of anæsthesia and produce pain. For this reason the anæsthesia is insufficient for a resection of cancer high in the rectum, for vaginal hysterectomy, or for the Watkins interposition operation.

Contra-indications to transsacral nerve block anæsthesia include deformities and anomalies of the sacrum in which it is impossible to enter the foramina. Only two such cases have been found. It should not be attempted in suppurative infection of the skin and subcutaneous tissues of the sacral region because of the risk of spreading infection. In three cases transsacral anæsthesia was not attempted because of this condition. Malignant disease of the sacrum and overlying tissues should also constitute a contra-indication. Although obese, very nervous, and hysterical patients are difficult to handle, transsacral nerve block is not contra-indicated in these patients.

SUMMARY

1. The efficiency of nerve block anæsthesia can be determined only in the absence of deep preliminary narcosis, terminal infiltration, and inhalation anæsthesia.

2. Transsacral nerve block with a low epidural injection gives absolute anæsthesia of the pelvic floor and viscera in practically 100 per cent of cases.

3. The technique requires practice and patience for mastery, but may be rapidly improved by experience on the human cadaver and skeleton.

4. The difficulty of execution of nerve block and the delay in the appearance of anæsthesia may be obviated by having the anæsthesia induced in a separate room especially equipped for the [illegible] and the injections performed by one especially skilled in this branch of work.

5. The amount and strength of the anæsthetic solution employed should be in proportion to the general condition of the patient and the probable size of the sacral foramina and nerve trunks.

6. In addition to its high degree of safety to the patient, transsacral anæsthesia creates as favorable an operative condition for the surgeon as general narcosis. The bother and consequent loss of the surgeon's time during operation when local infiltration is employed is thus avoided. Many operations have been performed under this method which would have been impossible with peripheral infiltration or the field block methods.

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PELVIC MEASUREMENTS BY X RAY

By ALFRED BAKER SPALDING, M.D.

IN 1921, Chamberlain and Newell published in detail a method of pelvimetry by means of roentgen-ray which they had developed in the department of roentgenology at Stanford University Hospital. This method is a simplification of the method published by Runge and Gruenhagen in [illegible] of the stereoscope as recommended by Manges in 1912.

The distinctive points in the new technique consist first, in the use of a plumb-bob hanging from a lead ring under the target which [illegible] 80 centimeters above the plane of the film; second, a wire stretched across under the patient; and third, a 10 centimeter rod which is placed on the body of the patient just above the symphysis.

For taking the stereoscopic plates the patient is placed on a Potter-Bucky diaphragm and the plumb-bob is adjusted vertically below the target (Fig. 1). This is accomplished by tilting the tube-holder until the shadows of the plumb-bob and the lead ring are concentric. The tube is brought over the right iliac region and an exposure made with the Coolidge tube about 15 seconds at 25 milliamperes at a nine-inch gap. The tube is then shifted 10 centimeters to the left, parallel to the wire above mentioned, and another film is exposed. When dry, the films are placed in the stereoscope, and the desired points to be measured are marked with a small ink dot. Then, on the light box a piece of clear celluloid is laid over one of the films and on it are marked, first, two dashes over the shadow of the wire; second, the center of the plumb-bob; and third, the points on the pelvis which are to be measured, labeling each pair. The celluloid is then laid over the other film, setting the dashes over the shadow of the wire, and the mark for the plumb-bob placed exactly 10 centimeters from the first plumb-bob shadow. The points in the pelvis are then marked in their new positions and lines are drawn connecting the plumb-bob dots with the pelvis dots belonging to each plate, and a third line connecting the intersections. This connecting line is marked *Y*. The line connecting the two points marking the sacrum is labeled *A* and the line connecting the two points marking the point of the promontory is labeled *B*. A centimeter scale laid on the *Y* gives the length in centimeters of the horizontal projection of the required diameter. A special scale laid on *A* and *B* gives the height [illegible] the plane of the film. The length of the conjugate is then computed from the formula:

[illegible]

[illegible] for the understanding of [illegible] mathematic computations for making the scale. But for measuring the various diameters of the pelvis it is necessary to [illegible] involved. The details of making this scale are [illegible] Chamberlain and Newell.

To correct for errors due either to a shifting of [illegible] measure the 10 centimeter rod placed on the patient. If this gives accurate measurement, then the various diameters of the pelvis will be

Fig. 1. The patient is placed on a Potter-Bucky diaphragm and the plumb-bob is adjusted vertically below the target.

[illegible]

TABLE I.—Summary of fourteen patients measured by roentgenologist.

				Roentgen Ray															
				Inlet							Outlet								
		SP	CR	I	LO	L	RO	BI	PS	AP	T	LO	RO	AP	T	AP	BI	AS	PS	Remarks
4								9												
5								9												Justomajor
3	Term							7												Clinical diagnosis, funnel pelvis
4	Transverse	26	28					8												Funnel pelvis
5		24			24		24	7	9											Clinical diagnosis, funnel pelvis
6	Breech Term							7												Clinical diagnosis, funnel pelvis
7	Breech Term							8												
8	Term		24					6												Clinical diagnosis, funnel pelvis
9	Term							7												Clinical diagnosis, funnel pelvis
10	Spontaneous Term		26					8												
11	Term							7												Clinical diagnosis, funnel pelvis
12					24			7												Clinical diagnosis, funnel pelvis
13	Cæsarean							9												Rachitic flat D.C. 10 Est. T.C. 8
14	Cæsarean 2nd							8												Flat pelvis;

TABLE II.—Comparison of pelvic measurements by pelvimeter and roentgenologist. 1 and 2, by roentgenologist. A to L, by clinical staff with pelvimeter.

	I. S.	I. C.	B. T.	L. O.	E. C.	R. O.	B. I.	P. S.
X		24.0		20.0	18.2	20.0	8.9	
X	19.6							
						19.0	9.25	
B		25.5				21.0		6.0
C		25.5	30.0	20.0	18.0		8.5	
D	21.0	25.0		20.5	19.0	20.5	9.0	7.0
E		26.0		20.0				
F	20.5	26.0		22.5		23.0	11.0	8.75
G	22.5		29.0				8.75	
H						21.25	9.0	
J	22.0	26.0				21.0	8.75	7.0
			28.5	20.0		21.0	9.0	
K		26.0		20.5		20.75	10.5	
L	21.0	26.0			21.0	21.25		6.5

accurate, providing the dots have been accurately placed on the plates. This is the one point in the method which depends upon individual technique for accurate mensuration. In measuring dried pelves the method has been found to be accurate within 2 millimeters.

The method is too expensive to be used as a measure of routine, but we have found it very helpful in cases with suspected abnormalities of the pelvis detected either with the usual methods of pelvimetry or from an abnormal progress in labor. Particularly has it been helpful in gauging more accurately the diameters of the outlet of the pelvis, and in two instances has been the deciding factor in inducing labor rather than resorting to a preliminary cæsarean section. In both instances the outcome of the labor proved the accuracy of the X-ray measurements. A summary of fourteen patients so measured is given in Table I. We have not utilized so far cephalic measurements, but with greater experience it does not seem unjustifiable to expect that with this method we should not be able to judge correctly the proper time for inducing labor in patients with moderate degrees of pelvic contraction.

In a marked obliquely contracted pelvis the impression given by external measurements was entirely changed by the accurate measurements for both oblique diameters which were found to be nearly equal.

An additional practical point that we have observed in the use of the X-ray measurements during the progress of a delayed labor is the accurate diagnosing of the position of the presenting part which is shown by the X-ray photograph.

It is more difficult for the roentgenologist to place the points accurately for external measurements because of the shadows of the iliac bones, but the method has great teaching value in correlating the various methods of external pelvimetry used by different members of the staff. This has been tested in a very interesting contest where the entire staff, including the attending obstetricians, senior house staff, junior house staff, and students have entered into a competition with the X-ray department. In this contest not only was the fact brought out that certain of the pelvimeters in regular use gave erroneous measurements, but also that different methods for measuring the pelvis showed quite varying degrees of accuracy (see Table II).

Not only did the measurements made by the clinical staff vary, but also there was a considerable variation in the two measurements made by different roentgenologists. At first glance, this might seem to throw doubt on the value of the X-ray measurements, but after considerable discussion in staff meeting, it was found on the side of the clinicians that not only were some of the instruments used defective, [illegible] not a unanimity of opinion as to the exact points from which the different measurements should be taken. This was particularly noticeable in the outlet measurements of the pelvis. Because of the size of the tuberosity of the ischium, different measurements will be obtained if the bis ischial is measured from the anterior edge, the middle portion, or the posterior edge, of the tuberosity. However, it will be noted in the chart that where short bis ischial measurements are made the same individual usually measured a long posterior sagittal. The measurements made by different roentgenologists are due not to errors in the technique of the method, but rather to misunderstandings as to the exact points between which the measurements should be taken.

Moreover, the roentgenologist, unless he is also a trained obstetrician, is not capable of expressing to patients the prognosis of labor based upon X-ray measurements. So many factors must be considered in regard to prognosis such as pelvic inclination, presentation and position, mechanism of labor, etc., that the obstetrician must rely on his training and past experience in this important matter, and can utilize X-ray measurements only as one factor to aid him in arriving at his decision. It is not sufficient for the obstetrician to read merely the written report from the roentgenologist, but he must study with the roentgenologist the stereoscopic pictures of the pelvis and satisfy himself that the points from which the measurements are taken are the points which in his judgment are essential.

AN ASEPTIC METHOD OF INTESTINAL ANASTOMOSIS

AN EXPERIMENTAL STUDY

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IN consequence of the lack of a satisfactory aseptic method (1) of intestinal anastomosis, and more especially because of the mortality from infection following open resection and suture of the large intestine, the present study was undertaken.

HISTORICAL

Methods and devices have been reported, which are intended to decrease the amount of soiling at the time of operation. However, it may be said that practically all of them necessitate the withdrawal of some instrument or material through the line of sutures in order to complete the anastomosis. One may mention for example, Frank's coupler (2) 1896–1899; the forceps of Laplace (3) 1898; O'Hara (4) 1900, Moszkowitz (5) 1908, and Gudin (6) 1916; Lee's holder (7) 1901; the release sutures of Pockhammer (8) 1906, Wullstein (9) 1908, and Grey (10) 1918; the elastic ligature of Silvestri and McGraw (11) 1891; and the elastic ligature and the gliding metallic draw-string of Pockhammer (8) 1906, and Werelius (12) 1906. Certain procedures have been advanced that are evidently not aseptic, but which facilitate making the anastomosis and in this way somewhat diminish the total amount of soiling. Among these may be included the Murphy metallic button (13) 1892, Abbe's catgut rings (14) 1892, Robson's (15) 1893 and Allingham's (16) 1895 decalcified bone bobbins, Halsted's inflated rubber cylinder (17) 1898, Harrington's (18) 1902 and Gould's (19) 1904 segmented rings with screw handle, Senn's bone plate (20), and other potato-, turnip-, carrot-, bread-, candy-, fibrin-, metallic-, and bone-plates, rings, buttons, cylinders, etc.

The bulkhead method, described by Dr. William Stewart Halsted (21) in 1910 and 1912, was perhaps one of the first more nearly to approach an aseptic operation. Recently (1921 and 1922) Dr. Halsted (1) reported the procedure of abutting the closed ends of the large intestine and puncturing the double diaphragm with an instrument passed per rectum.

In 1916–1917 one of us (Burket) studied various ways to lessen the amount of soiling which occurs during intestinal anastomosis. A wire loop, similar to a tonsil snare, was used to cut through the invaginated stumps of the abutted, closed ends of the intestines. This required the withdrawal of the wires through the line of sutures, and also left a long turned-in cuff of intestinal wall. When the wire was pulled out, the submucosa was occasionally dragged through the suture line and into the metallic tube through which the wire loop worked. Later an instrument was devised, which consisted of a series of knife blades, united to form a diaphragm (like the kodak iris diaphragm), which could be closed by lateral pressure. However, this instrument was difficult to maintain in position, as inserted, and also left a long flap of intestinal wall hanging within the lumen. Various release sutures were studied, but they also necessitated turning in too much intestinal wall and withdrawal of material through the suture line.

Subsequently we have developed an aseptic method of intestinal anastomosis which is dependent for success upon an instrument (Fig. 1) formed of reciprocal male and female halves.

DESCRIPTION OF INSTRUMENT

The male half of the instrument consists of a cylindrical knife blade *a* (Fig. 2), mounted at its back on a central shaft, which is threaded on the portion within and in front of the blade, in order to hold the ratchet of the female tube. A small button *a3*, to serve as a handle with which to rotate the knife, is fastened by the pin *a4* to the rear end of the shaft. The outer surface and back of the cylindrical knife are completely encased in a rigid cover *a2*. The center of the back of this protecting cover is perforated by the shaft and near the center is fastened a small rod, which extends forward through the inside of the cylindrical knife. A spring ratchet is attached to the front end of the rod.

The female half of the instrument is formed of a solid, somewhat conical-shaped structure, *b1*, which contains a projecting central metallic ratchet tube, on the upper surface of which is a metal groove to receive the male protecting-cover rod. Above the groove, within the solid part, is a threaded metallic surface *b3* on which the cover-rod ratchet catches. The female half of the instrument is composed of three distinct

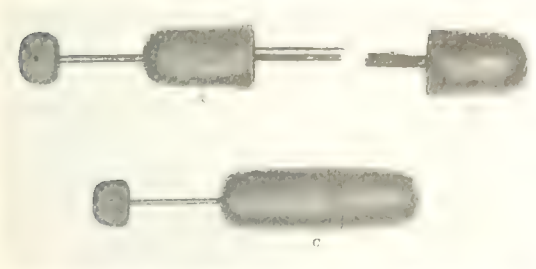

Fig. 1. *a*, Male half and *b*, female half of instrument assembled and ready to invaginate. Shows the instrument completely reciprocated together and within which only the cylindrical blade is freely movable for cutting and advanced by means of turning the button on the end of the knife-blade shaft.

segments *b1*, *b2*, and *b3*, which articulate in such a manner that, when assembled, they can be locked immovable by means of a pin *b4*, which perforates the segments from side to side. The segments are essential in order to release the ratchets and to permit easy inspection of the threads, central tube, and groove. A pasteboard disk *b5* covers the flat hard surface of the female half in order to protect the keenness of the circular cutting edge of the male knife blade.

OPERATIVE METHOD OF INTESTINAL ANASTOMOSIS

Our aseptic method of intestinal anastomosis (Fig. 3) is as follows: The intestine is resected between two ligatures of heavy silk, with the cautery knife. Each cauterized end of intestine is invaginated like an appendix stump. The male and female halves (Fig. 1, *a* and *b*) of the instrument described, are inserted one into each gut-end at this time and help to push inward the ligated, cauterized stumps. The two parts of the instrument are so placed that, when they are fastened together, the mesenteric borders will be accurately coapted. Each half of the instrument is held in its respective gut-end by a purse-string suture, which draws a double-walled diaphragm of intestine over each part of the instrument and which is tied down on the projecting central tube, after the instrument has been pushed together just sufficiently to permit the central tube to extend under the edge of the cylindrical blade. It is well, first, to tie the purse-string suture of the female part firmly about the central tube, and then to tie that of the male part loosely around the same tube. After the diaphragms and sutures are carefully inspected to see that all is in the proper position, the halves of the instrument are reciprocated together snugly against the intervening layers of intestinal wall, without

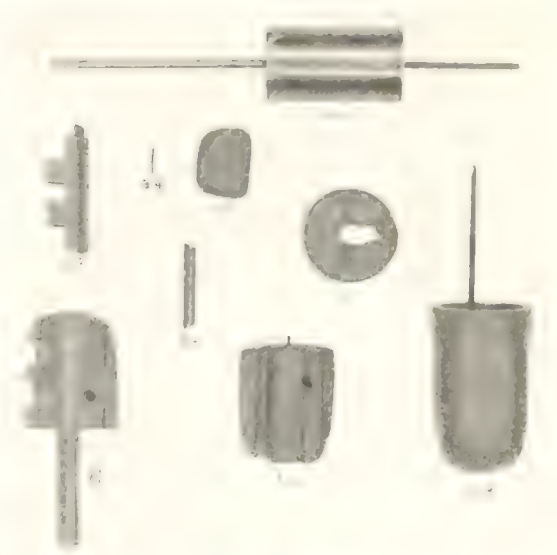

Fig. 2. Instrument un[illegible]

traumatizing the gut (Fig. 3). Thus the double diaphragms of the intestinal wall are firmly fixed against the flat surface of the female portion by means of the rigid protecting cover of the cylindrical knife of the male half of the instrument. The intestines are readily anastomosed with interrupted fine black silk sutures. The instrument makes an excellent form on which to take the stitches. It is well to place but not to tie the mesenteric border mattress suture before the two halves of the instrument are ratcheted together, as it is easier at that time accurately to place the stitch, and one can thus be certain of a neat and strong approximation of the mesenteric border. After the mattress sutures have been placed and tied, the operator with his left hand gently grasps the wet cotton-covered intestine which contains the body of the instrument, and with his right hand turns the cylindrical knife by gently manipulating, through the gut wall, the button on the end of the shaft. The button is turned slightly from side to side and moved forward as the knife cuts through the intestinal diaphragms which intervene between its circular edge and the solid surface of the female part. As the knife is the only movable structure within the instrument and the gut layers are firmly fixed against the female block by the protecting cover of the knife, it cuts through the diaphragms and the hand easily detects by feeling when the knife edge reaches the resistance of the hard surface of the female part. The[illegible] instrument as a

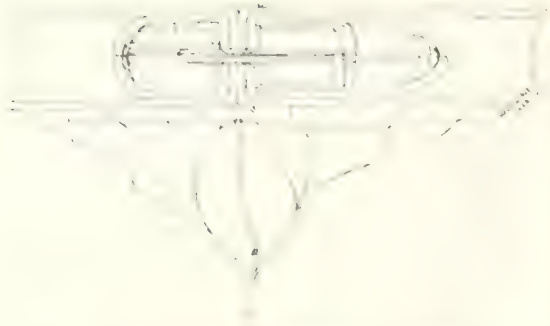

Fig. 3. Diagrammatic longitudinal section; aseptic method of intestinal anastomosis; instrument invaginated into gut ends and reciprocated together ready for intestinal suture and manipulation of cylindrical blade in order to cut out the intervening diaphragms of gut wall.

whole and covered by the invaginated portions of the intestine, slips free and may be slid along out of the gut, or to any desired distance from the field, and permitted to be expelled by the intestines. Thus is promptly re-established the lumen of the intestine, which has not been opened[1] at any time during the operation. The disk of intestinal wall that is excised by the cylindrical blade in order to re-establish the lumen is shown in Figure 4, *a* and *b*. The rent in the mesentery is closed with a running glove suture, care being taken to avoid injury to any blood vessels which may supply the region of the anastomosis. The remaining inturned intestinal collar is just the desired length and, indeed, can be made almost any length by simply turning in more gut wall by means of another anastomotic row of interrupted mattress sutures.

STUDY OF THE ASEPTIC METHOD

We have employed the above method frequently on freshly isolated pig's intestine and also, by aseptic operation, on living dogs under ether anæsthesia.

We have determined that a smooth-edged, solid, circular knife blade (Fig. 2, *a1*) cuts easily, cleanly, and uniformly against a solid surface; while an irregular, serrated, or scallop-edged knife or a series of knife blades seem to be unsatisfactory because almost invariably shreds of submucosa are dragged into the crevices of the blade. These shreds are difficult, finally to divide completely, and hence, complicate the operation.

We have other designs of instruments which work, but thus far the form described in this report is the most satisfactory. A series of different-sized instruments is at hand in order to be adaptable to intestines of varying diameter.

[1] At each site of resection, the intestine is divided by the actual cautery between two tightly placed ligatures and the stumps are thoroughly cauterized during this procedure.

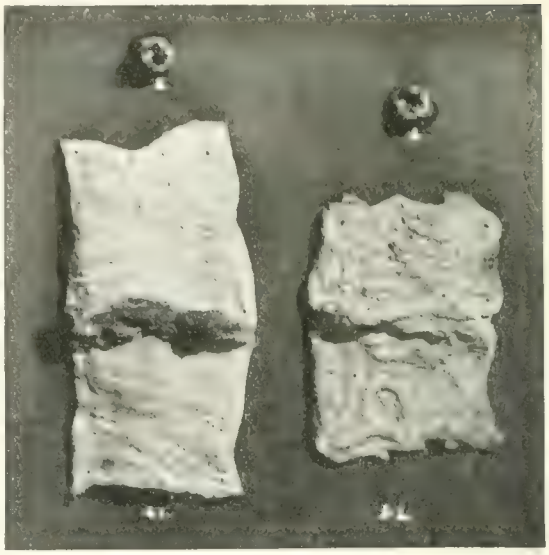

Fig. 4. Specimens of healing anastomosis from dogs that were operated upon by this method; *a1*, healing at end of seven days; *a*, shows the disk of the diaphragm of the abutted intestinal walls that was cut out by the cylindrical knife in order to re-establish the lumen in specimen *a1*, and which passed per rectum (together with the instrument) within 40 hours after operation; *b1*, healing at end of 14 days; *b*, the disk removed by the cylindrical knife from specimen *b1*, and which passed per rectum (with the instrument) within 40 hours from the time of operation.

The method is suitable for small and large intestines.

ADVANTAGES

The advantages of this method of intestinal anastomosis are that—

1. It cuts through the closed abutted ends of the gut and promptly re-establishes the lumen without exposing the operative field to soiling from the opened intestine or by the withdrawal of any material or instrumental device through the line of sutures;

2. No mechanical device is left *in situ* to interfere with the healing (as is the case of the Murphy button). The cylindrical knife serves only as one of the temporary instruments of the operation, just as do the needles and hæmostats, and is removed from the field before the operation is completed;

3. The remaining inturned cuff of intestinal wall is a desirable length, and is neatly, sharply, and uniformly cut;

4. An anastomotic opening is obtained which closely approximates in diameter the gut lumen

and thus removes the opportunity for temporary obstruction, or too great narrowing of the lumen which results from a long inturned collar of intestines;

5. Soiling is reduced to a minimum, dependent upon the effectiveness of the cautery and the skill with which sutures are placed in the submucosa without penetrating the mucosa.

It is intended at a later date to present further studies with our aseptic method of intestinal anastomosis.

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EDITORIALS

SURGERY, GYNECOLOGY AND OBSTETRICS

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DECEMBER, 1922

THE UNNECESSARY OPERATION

WELL-EXECUTED surgical procedures for disabling symptoms due to definite and removable causes are most brilliant and beneficent in their immediate and permanent results. There is a large group of so-called neurotic individuals who have all sorts of real and imaginary symptoms that mimic very closely every variety of organic disease. Operations, when extended to this type, have been followed by the most disappointing results. In the evolution of abdominal surgery, the ovary, the retroverted uterus, the mobile kidney, the functional stomach disorder, the colon, and the gall bladder have in turn been subjected to operation. All were of the neuropathic habitus, many had the stigmata of degeneracy and had operations chronologically on the organs in the order named for practically the same symptoms with slight variations. Surgeons found the futility of such measures and abandoned largely any operative attack upon these organs without very definite and genuine indications. There yet remain well-meaning men who lack discrimination and experience and make the error of attempting to extend operative relief to this unfortunate type of individual upon insufficient clinical data and inadequate pathological criteria. There are regrettably some unconscionable pot-hunters who will operate on anybody that will hold still. Every hospital should eliminate that kind of man.

For those possessing judgment and honesty, the ubiquitous neurotic whose complaint simulates real pathology challenges his scrutiny and restraint. Metastatic lesions are miraculously cured by the removal of real foci of infection, yet it is being notoriously misapplied and tremendously overdone. The uncured peripatetic "neuro" now commonly relates operations obviously unnecessary upon the tonsils, antra or teeth instead of decorations made by numerous abdominal incisions as formerly. The general surgeon with a wide experience in handling all types of disease has learned how to *triage* the neurotic, but the unwary and enthusiastic specialist too often subjects them to unnecessary operations for the cure of bizarre symptoms.

Dysfunction of the abdominal organs constitutes a very uncertain land of shifting sands. The neurotic condition is most persistent, resistant, and insistent. The symptoms are so vivid and the plaint is so repeated that many men fail to evaluate them correctly. The chronicity and rebelliousness of these cases make them hard to decline. A humorous publication very significantly says: "If you go to the doctor often enough you will be operated upon."

There are so many functional disorders of the digestive system, without physical lesions in the stomach itself or the satellite gall bladder and appendix, that it behooves the

examiner to be most thorough-going. It is inexcusable to overlook cardiorenal and pulmonary diseases, parasites, anæmias, disorders of the central and spinal nervous system that produce digestive symptoms. The X-ray, fortunately, can isolate practically all of the organic lesions of the stomach. The intangible nervous system that complains so bitterly is our pitfall.

Peristalsis and the secretory processes are not felt or perceived by an individual who is normally innervated. They doubtless transmit sensations to the brain that have to do with the healthful state and certainly with many abnormal states. The neurotic, however, is keenly perceptive of these sensations that are unknown to the normal individual and in him it amounts to pain. The autonomic nervous mechanism is most delicate and influences us dominantly for good or ill. The vasomotor changes on the surface of the body such as pallor, blushing, and the lesser emotions are such common evidences and yet are so striking and varied as to constitute the film of the novelist in his description of the emotional states, such as fright, pain, fear, or elation. The elder Eastman once said that when a magnet receives a powerful blow on the anvil, it ceases to magnetize, and when the nervous system of a woman receives a terrible emotional blow it ceases to function properly.

Moreover, if excessive stimulation of the sympathetic system is constantly repeated by worry, doubt, anxiety, and solicitude, the endocrine system which is dominated by the sympathetic is affected, and the condition of chronic nerve tire with its pitiable manifestations occurs. The smooth-running, physiological mechanism presided over by the sympathetic jangles "like sweet bells out of tune." It is chance whether the gastro-intestinal function is affected or the vasomotor system, or both

The sympathetic system controlled man before the central nervous system came into being, and protected him in the primitive state from physical danger. Civilization has lessened the imminence of these dangers but substituted the more insidious and deadly danger of gruelling strenuosity and the vexatious anxiety of competitive life. The autonomic nervous system in the effort to protect man from his new enemies suffers bolshevism. It then gives rise to the various abdominal symptoms that are spoken of as vagatonia and are, when more wide-spread, denominated neuro-circulatory asthenia. They are often associated not only with abdominal and pelvic complaint but with pain referred to the head and back. These patients suffer so and their families and friends more so and over such a long time they think they have organic disease and will not be otherwise persuaded.

Introspection sometimes causes fixed ideation about disease and its seriousness, and requires the most clear-visioned, skillful and sympathetic medical management rather than surgical exploitation. Instead the surgeon is often importuned. The cases are frequently referred by the most accomplished diagnosticians who eliminate every possible source of demonstrable disease by a complete examination but assume there must be some organic trouble failing, as they do, in the final analysis to interpret the interplay of the nervous system. The organ of course that is blamed the most is the appendix and while fortunately it can be spared, an unnecessary operation, even upon that organ, is not an unmixed blessing and is often unavailing and discouraging. Seemingly satisfactory results are apparently obtained occasionally but it must be realized by thoughtful men that they are purely the result of suggestion. Surgery is a very dangerous type of suggestive therapeutics. Chronic appendicitis is so easy to say and still means

so little. If it means anything in the history of a patient it means that it was probably an unnecessary operation upon a neurasthenic. It is never diagnosed in patients with a normal nervous system. Occasionally one will be beguiled into operating upon these patients and greatly mortified to find a small, cord-like, white, obliterative appendix that certainly is incapable of producing symptoms. We have little reason for diagnosing chronic appendicitis in the absence of definite acute or subacute attacks. Renal and ureteral stone often masquerade as appendicitis. Surgeons are most astute in the elimination and detection of a demonstrable disease. The place they fail is in operating upon people who have no organic disease, but make a noise like they really had, but we can't always diagnose that he hasn't anything. It is lamentable that a considerable number of people have had unnecessary operations upon the lowly appendix and other normal organs without benefit. The patient with a throbbing abdominal aorta or blood pressure of 100, should have no surgery that is not imperative. The thin asthenic, ptotic woman may and can have organic disease but she is the vamp of the diagnostician and the lure of the surgeon.

WILLIAM D. HAGGARD.

RELATIONSHIP BETWEEN THE ILEOCÆCAL COIL AND ARTHRITIS DEFORMANS

CHRONIC polyarthritis in our opinion has its origin in a focal infection in the intestinal tract, due to an unbalanced or perverted intestinal flora, made possible by the failure of some part of the ileocæcal coil to empty itself properly. From the careful and repeated X-ray examination of one hundred cases of arthritis and the abdominal operative findings in sixty cases, we have been able to draw some very definite conclusions as to the existence of an intestinal focus of infection, the nature of the intestinal deformity, and the method of its production.

Infections of the teeth and tonsils are undoubtedly the cause of many cases of acute arthritis, and their removal quickly clears up the symptoms. But in chronic cases, the removal of tonsils and teeth has, as a rule, very little permanent effect, the reason being that an intestinal infection has taken place and a larger focus developed, so that then the clearing up of the head foci hardly affects the load of infection at all.

The similarity of the picture of the ileocæcal coil in all of these cases has led us to the conclusion that the typical soil for development of arthritis is a congenitally mobile cæcum which has been tacked back to the side wall of the abdomen by nature in an effort to lift up and anchor a prolapsing organ.

By a reduplication of peritoneum starting at the right colic artery and extending to the parietal peritoneum over the right kidney, the colon is rolled and folded so that it gives the appearance of an hour glass, with the cæcum thin walled and toneless. There is usually a binding down of the ileum somewhere in its terminal 8 inches (20 centimeters), increasing the torsion in the ascending colon so that the physiological function of the colon is crippled and the cæcum becomes an inert sac, which does not empty itself. This sac constantly filled with culture medium becomes infected with streptococcus, either from a head infection or from the terminal ileum, which is the natural habitat of the *streptococcus viridans*. The streptococcus becomes then the predominating colon organism and we have an overbalanced flora resulting, which, in its turn, becomes the focus of infection that keeps up the arthritic disease.

The most striking results following the removal of the right colon have proven to us

the colonic origin of the disease. The removal of the right colon deprives the patient of his filter and for 10 days there is practically no water absorbed by the intestinal tract. It becomes necessary to give this patient water under the skin in order to prevent dehydration. Our routine consists of giving a quart (1 liter) of salt solution daily by hypodermoclysis until the quantity of urine increases from 1,000 to 2,000 cubic centimeters. This happens usually from the tenth to the twelfth day. During this ten-day period the patient makes a wonderful recovery from joint trouble. In from 48 to 72 hours, the swelling disappears and the joints become more and more movable and the pain entirely disappears; but on the day the quantity of urine doubles, showing that the intestinal tract is again absorbing water, the symptoms recur. The perverted flora is still able to act as a focal infection and the joints then clear up slowly as the flora returns to normal. The removal of the right colon, however, in debilitated patients is rather a formidable procedure and we have endeavored to develop a method of restoring the physiological function of the crippled cæcum without its removal.

The interference with physiological function of the cæcum is easily demonstrated by dividing the constricting band with a sharp knife at its junction with the parietal peritoneum. The ascending colon immediately rolls out until 3 or 4 inches (7.6 or 10 centimeters) separate the ends of the divided band, and the cæcum regains its normal color and contracts on mechanical stimulation. We believe that the interposition of tissue is the most important step in preventing recurrence and we use free omental grafts to fill in all gaps and cover all denuded surfaces.

We have found the unpuckered vermiform appendix, spread out and turned over toward the midline, most useful in covering the denuded surface developing on the mesentery of the ileum after the division of a "Lane's kink," and we believe that again the interposition of tissue is most important in preventing a recontraction of peritoneal surfaces and a redevelopment of the kink.

If there is no mechanical intestinal abnormality, but instead a general colon sluggishness, the after surgical treatment designed to re-establish a normal intestinal flora, without surgery, will produce the same result. We have, in a number of cases, obtained great symptomatic improvement by this treatment without any surgical procedure. Other patients, treated medically without any improvement, have had an immediate relief of symptoms following a surgical procedure to remove the intestinal blockade, after which the same medical régime was resumed.

The joints become amenable to orthopedic treatment as soon as the pain subsides, and operations and manipulations can be carried out without fear of lighting up another attack of acute inflammation, which always hampers the orthopedic surgeon when he attempts any radical procedure in the presence of the infection.

REA SMITH.

MASTER SURGEONS OF AMERICA

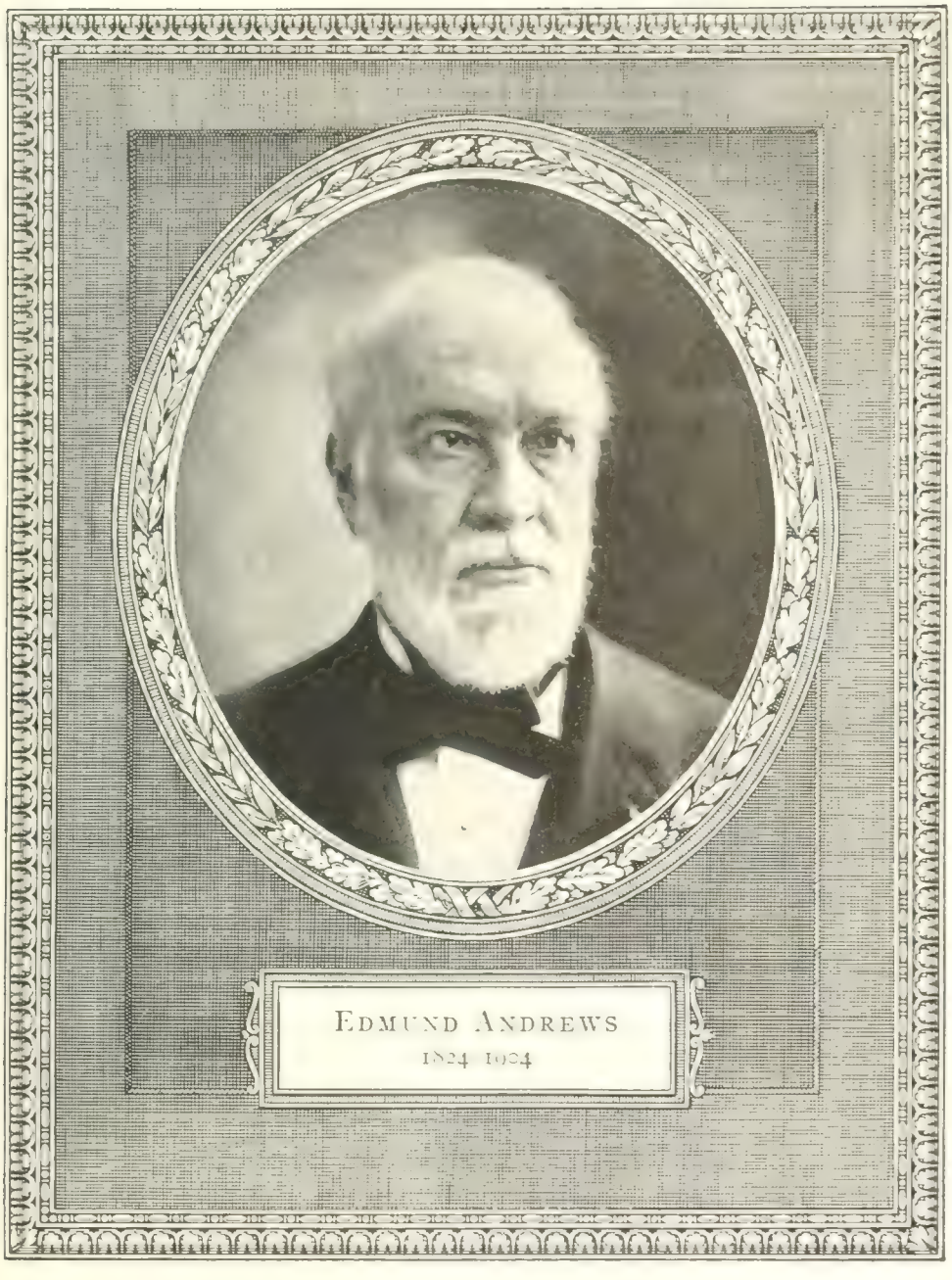
EDMUND ANDREWS

DR. ANDREWS was born in Putney, Vermont, in 1824, and died in Chicago, in 1904. His father was the Rev. Dr. E. D. Andrews, a Congregational minister, and his mother, Mrs. Andrews (née Lathrop), was the daughter of a physician. The family history shows an unbroken line of American-born ancestors dating back to 1728. His grandfather was a soldier in the Revolutionary War. A brother of Edmund was a medical missionary in Hawaii and a graduate of Dartmouth. This brother was the father of the late Dr. George P. Andrews, sometime dean of the Detroit Medical College and professor of medicine in that institution. Another brother was a federal judge in Knoxville, Tennessee.

In the early days and especially in rural communities, the meagerness of the salary of a minister of the Gospel made it necessary for him to employ additional measures of support, and young Andrews from early boyhood, became inured to the hardy discipline of his father's farm. But this was never allowed to interfere with attendance at the best schools in the neighborhood, and on occasions home instruction was given as well. He describes himself at this period of life as a great straddle-legged rustic who had not achieved noticeable popularity as a beau. Loss of voice compelled the father to withdraw from the ministry, and, after several smaller changes in location, in 1841 the family moved to Armada, Michigan, and there proceeded to carve a fine farm out of the primeval forest. Meantime young Andrews was kept at his studies as diligently as possible, and his preparatory work was so well accomplished in the Academy of Romeo, Michigan, that in 1846 he was admitted to the sophomore class of the University of Michigan, which just then had opened its doors.

During his career as a student he manifested a decided preference for the scientific studies, and this preference dominated his activities throughout life. While attending his class work he helped out his expenses by teaching vocal music and leading the church choir.

He received his bachelor's degree in 1849 and in 1850 entered the medical Department of the University which that year opened its doors for the first time. In 1852, he received his medical degree and also his master's degree, and in 1881 his Alma Mater conferred upon him the final degree of LL.D.



EDMUND ANDREWS

1824 1904

Immediately after his graduation Dr. Andrews was elected demonstrator of anatomy in his Alma Mater and a year later was made professor of comparative anatomy. In 1856 he came to Chicago to accept the demonstratorship of anatomy in the Rush Medical College, but he soon found this position to be uncongenial and relinquished it.

While still connected with the University of Michigan the young philosopher had published several essays in the medical periodicals of the country, in which he advocated a graded system of medical teaching and the requirement for admission to medical colleges of a respectable measure of preliminary scholarship. It was, therefore, easy and natural for young Andrews to join with N. S. Davis, H. A. Johnson and other physicians of like spirit, in founding the Chicago Medical College, which was the first medical college in the United States to adopt a graded system of instruction. Dr. Andrews occupied the chair of surgery and clinical surgery in this institution for many years.

When Dr. Andrews came to Chicago he left behind him in Michigan two remembrancers: The Michigan State Medical Society, of which he was one of the organizers, and the *Peninsular Journal of Medicine and the Collateral Sciences*, of which he was one of the founders.

Early in the Civil War, Dr. Andrews was appointed surgeon-in-chief of Camp Douglas in Chicago, then a training camp for state troops; but soon after he was appointed to the Federal Service as surgeon of the First Illinois Light Artillery, and served in the campaigns against Shiloh, Corinth, and Vicksburg. After some months of hard service he contracted dysentery which, continuing without check or abatement, finally became so severe as to imperil his life and compel him to withdraw from the service. Full recovery required a year and a half of careful treatment after his return to Chicago.

During his military service he was the first to keep systematic records of army cases of disease and injury. His reports to the Surgeon General have been used as the basis on which the records of the office of the Surgeon General have since been kept. Some time after his withdrawal from the army, Dr. Andrews published a very extensive essay on military statistics, which was accepted by later writers as authoritative for many years.

He visited Europe in 1866 and spent his time mostly in the hospitals of Paris and London. He was powerfully impressed by the teachings of Lister.

One of the most notable of Dr. Andrews' labors was the study of the relative dangers attending the induction of anæsthesia by chloroform, ether, nitrous oxide, and a mixture of chloroform, ether and alcohol. His conclusions, based on the analysis of hundreds of thousands of cases, were quoted as authoritative in current and textbook literature for many years thereafter. A fact not generally known is that Dr. Andrews was the first to test, and to write on "Gas-Oxygen Anæsthesia."

In *Science*, August, 1911, Professor Charles Baskerville of the College of New York, refers to the experiments of Dr. Andrews in 1868 with a mixture of oxygen and nitrous oxide to produce a non asphyxial anæsthesia and then says: "Although Andrews published accounts of several cases in which the mixture had produced more satisfactory anæsthesia than the nitrous oxide alone, his observations failed to attract the attention they deserved," obviously because the accounts had not been published in a medical journal at all but in a science magazine.

There was very little unemployed time in Dr. Andrews' life. He was a tireless investigator. Recreation was sought in the wilds of nature. His frequent excursions to mountains and forests and rocky islands and lakes and rivers, although they furnished boundless delight and begat an exaltation of spirit in the contemplation of the grandeur and sublimity of nature's works that was very near to worship, had other objects in view. They were used in the observation of countless botanical, zoological and geological facts. The museum of the University of Michigan and the Chicago Academy of Science bear eloquent testimony to this effect.

Dr. Andrews was one of the founders of the Chicago Academy of Science and served for many years as its president. There were coadjutors and noble financial supporters. But through lean and fainting years, through years of discouragement and years of disaster and years of almost complete abandonment, it was Edmund Andrews and, at times he almost alone, who held fast the self-sacrificing courage of love and duty. It is now a noble monument—the repository of matchless treasures; but the noblest thing it can show is the story of its struggle for existence, and in that story the name of Edmund Andrews will forever be the lustrous feature.

As a surgeon Dr. Andrews was always in the forefront of progress. Of mechanical bent he originated a number of orthopedic appliances and other instruments which contributed to the growth and precision of the mechanics of surgery. For many years he was the only surgeon in Chicago who limited his work exclusively to surgery.

He was the first to use Listerism or antisepsis in Chicago. These were the pioneer days of modern surgery. Asepsis had not been thought of. The efforts to prevent surgical sepsis were, of course, faulty and often ineffective, but the fighting investigators struggled on and on toward the truth, and Edmund Andrews struggled as patiently and valiantly as any.

When one does the work of his day so conspicuously well that his brethren of the profession accept him as teacher and guide, the historian can do no less than make respectful obeisance and pass on.

As a teacher of surgery Dr. Andrews was always profoundly respected, yes, and loved, by his students. He was not a fluent speaker—he made no attempt

whatever at grace or elegance of diction,—but his utterances were unfailingly delivered with earnestness and power, and he was a great explainer and entertainer. He was there to teach and he taught well.

He carried no levity into the lecture room, though his bearing was always amiable and kindly and patient, and his words were often supplemented by offhand drawings on the blackboard. He was delightfully deft with the crayon and his illustrations, made with apparent casualness of stroke and without interfering with the consecutiveness of his speech in the smallest detail, contributed entertainingly to the clarity of his expositions. His mouth was as clean as a little girl's. A large heavy bustling personality,—a delightful laughter, a laugh which was not merely vocal and facial but included the shaking participation of his whole body and was full of happiness and mirth and reality. You had to laugh with him whether you saw the joke or not.

But he did not spend much time that way. He was too busy.

In times of quietness he often presented the appearance of preoccupancy of mind, not vacuity but concentrated activity,—the expression of a man whose mind was busy with problems and full of them. He loved problems and lived with them.

In relation to his fellow men, his mind was remarkably free from unfriendliness. Hollister, who had known him intimately since their school-boy days, testifies that he had never heard an unfriendly or a caustic word from Dr. Andrews' lips concerning another member of the profession. He exemplified in his conversations the truth of the scriptural declaration that "Charity suffereth long and is kind." He could hardly fail to be a devout man born as he was into an atmosphere of religion and reared in it. But his religion was very unobtrusive. He merely lived it—that is all.

Dr. Edmund Andrews, scholar, thinker, investigator, who under the guise of honestly seeking information was usually giving more than he received. Modest in demeanor, he was generally regarded as the most learned—at least as one of the most learned,—members of his profession. He left some enduring proofs of his usefulness to the world:

The Museum of the University of Michigan,
The Michigan State Medical Society,
The Chicago Medical College,
Origination of Army Records in the Surgeon General's Office,
Original Studies and Records of Gas-Oxygen Anæsthesia,
The Chicago Academy of Science.

WILLIAM E. QUINE

TRANSACTIONS OF SOCIETIES

CHICAGO GYNECOLOGICAL SOCIETY

Regular Meeting Held May 19, 1922, Dr. William C. Danforth, Presiding

URETERO-ABDOMINAL FISTULA

Dr. Emil Ries: The patient, a woman, 37 years of age, was married in 1906. In 1908 she was operated on, at which time she says that two tubes, one ovary, and the appendix were removed. She was in fairly good health until 1920, when she began to have protracted and copious menstruations. She was operated on December 1, 1921, by another operator who found a great deal of difficulty in removing the large uterus because of adhesions. Three or 4 days after operation watery fluid came out of the abdominal incision which had been made close to the first—a median incision. This fluid soon gave evidence of being urine. From that time until I saw the patient she continued to discharge urine through the sinus in the abdominal incision. At the same time she urinated in good quantities through the natural channels. When she came to me on March 5, 1922, she was wearing a glass tube in the fistula which was connected with a rubber glove, the latter serving as a sort of urinal. The skin of the abdomen was dark and eroded, the result of being constantly wet with urine and partly on account of the adhesive plaster that held the glass tube. It took from March 5th to 13th to heal this condition so I could operate.

Examination of the patient showed a fistula with some granulation tissue. The urine from that opening was cloudy, while that from the bladder was clear. An instrument introduced into the bladder did not come in contact with an instrument introduced into the fistula and the one introduced in the bladder did not come out through the fistula. Cystoscopic examination showed the bladder normal except for considerable congestion in the trigone, and the right ureter admitted the ureteral catheter to 5 centimeters, the left to 13 centimeters. The left ureteral catheter showed a free flow of urine, while there was none from the right. The right ureter was dead.

On March 13 I made a right rectus incision and found adhesions so extensive that it was possible to leave the abdominal cavity closed and do the operation extraperitoneally. The cæcum and ascending colon were pushed toward the median line and dissected out posteriorly. It was easy to find the right ureter which was as thick as my little finger and full of fluid. I followed that up to the kidney. It was more difficult toward the bladder because the bladder was bound down by adhesions to the peritoneum and there was considerable scar tissue all along the bladder wall. However, I dissected the bladder free on the right side sufficiently so that I could push it up with a catheter introduced through the ureter. I hoped to get enough of the bladder wall movable to make an anastomosis possible. The ureter was dissected free down into the broad ligament where it disappeared into the scar tissue. At this point it was cut off and I attempted to draw that ureter into the bladder. I made an opening into the bladder over the catheter. I then put two linen thread guides into the ureter and passed them through the catheter and pulled out the catheter. Twice the linen guides in the ureter tore out because there was too much tension. The third time, after loosening up the bladder more and pushing it up toward the right side, I succeeded in getting the ureter into the bladder with a chance of its holding. The ureter was then attached to the bladder in the usual way with a few sutures. Guides were left in end of ureter and in urethra and fastened outside by usual means.

In three days, urine was again escaping through the fistula. The patient's temperature began to rise and there were symptoms of a urinary infiltration. Forty-eight hours after the first operation I opened the sutures and found the ureter without any difficulty because it was necessary only to push aside the cæcum. The ureter was apparently well fastened to the bladder but since it leaked it was evidently not fastened well enough. I cut the threads, sewed up the opening in the bladder, tied a knot in the ureter, and put a ligature over the knot. I tied only a single knot because there was not enough ureter to tie more. The ureter was as thick as my little finger and did not tie very well. However, I put a linen ligature below the knot. At the time of operation the urine was smoky. The patient continued to have temperature and in a few days began to pass urine through the wound. I opened it again and removed the kidney and ureter on the right side. It was very simple and took about 25 minutes. This kidney is an infected hydronephrosis. There had been a stricture in consequence of the fistulous formation. As is so frequently the case where there is stricture formation there was a hydro-ureter and hydronephrosis. The pelvis of the kidney is large and the ureter much thickened. After the nephrectomy the patient made a perfectly smooth recovery. I saw her about 10 days ago and she is perfectly well.

This case is interesting from more than one angle: First, as to the cause of the hole in the ureter. It was probably the result of some kind of trauma. I learned that the operator who previously had the case passed some artery forceps down into the pelvis and left them there for 4 hours because of the severe hæmorrhage. It is possible that one of those forceps caught the ureter and produced gangrene. Second, the fact that the fistula was not a ureterovaginal one, but a uretero-abdominal fistula extending some distance from the point at which the ureter was strictured to the abdominal wall. Third, as to the formation of the walls of such a large fistula extending from way down in the broad ligament to the abdominal wall. The bladder formed the anterior wall of the sinus and the ureter was cut near the point where it entered the bladder. My ureteral catheter entered for a distance of 5 centimeters. The abdominal cavity was protected by adhesions.

A problem which arises in such cases is whether, if there is a leak after an anastomosis, it is wiser to wait or to risk a second operation 48 hours after the first. I decided that I would rather operate again than expose the patient to urinary infiltration. I think the outcome justified my decision. Why the ureter did not hold I believe was due to the fact that it was too short.

There is nothing to be said about the kidney specimen except this, we are all trying conservative operations on such fistulous ureters, we are all trying to save kidneys, but where the kidney continues to discharge cloudy urine it is a question whether the ureter will ever return to normal. When a kidney is not perfectly normal a nephrectomy is a much more simple operation than is an attempt to save the kidney by working in the adhesions of two or three previous operations. This is especially true when it is impossible to determine how much anatomical change has been produced or how much damage has been done.

DISCUSSION

Dr. T. J. Watkins: In such cases I occasionally have been tempted to make a tongue-shaped flap of the bladder wall for an anastomosis for a short ureter, but have never done it.

Dr. Emil Ries (closing the discussion): Flap methods are often used in stomach surgery for the purpose of making a fistula. The Witzel fistula has been recommended for the bladder. In this particular case such a flap might have allowed of lengthening of the bladder, so that the bladder would have met the ureter more closely, but there was so much cicatricial change that I left that out of the question.

ANACATADIDYMUS TERAS

Dr. Louis Gambee: This specimen is the result of a first pregnancy in a woman, 27 years old, a case of Dr. Simon. There was nothing of interest in the history, nothing in the way of abnormality, and nothing in the clinical history. This fœtus is a double monster in which there is a union from the pubes to the urachus. Some of these monsters have two, three, or four legs. The four-legged variety, of which this is a specimen, is known as the anacatadidymus teras (?). In these cases there is usually some abnormality in the genitalia, [illegible] recta and ani or simply one anus.

DISCUSSION

Dr. Joseph L. Baer: This specimen is the third pair of united twins we have had at Michael [illegible] Hospital in 4 years. [illegible] specimen that is being passed around.

ABDOMINAL TUMOR CONSISTING OF SMALL INTESTINE WITHIN PERITONEAL [illegible]

Dr. Joseph L. Baer: This patient, [illegible] entered the hospital in the night [illegible] in the right lower quadrant of the abdomen. Examination showed a mass about the [illegible] head which was globular in form and movable. There were some obstructive symptoms. At laparotomy the next day the mass was found to occupy the left lower quadrant and consisted of bowel. Because of inability on the operating table to determine whether it was malignant or obstructive a resection was done between clamps, the bowel removed being the terminal end of the ileum. The ends of the bowel were closed and turned in and a lateral anastomosis was done from the proximal end of the ileum to the head of the cæcum. Following that the circulation of the appendix seemed to be involved and because of discoloration an appendectomy was done. Recovery was uneventful without further obstructive symptoms. The tumor on being opened proved to be only a mass of small intestine enclosed within a peritoneal sac. The report of the pathologist was as follows:

"*Gross.* Convoluted mass of small intestine covered by thin smooth membrane of the appendices [illegible] mesentery. The mass as received is 22 centimeters long with folds and convolutions. By separating the adhesions this intestine is 64 centimeters long. The mucosa and submucosa along the muscle nodes are normal. The serosa is thickened and is infiltrated by eosinophiles and lymphocytes. Similar cells are also present in the outer muscular layer. There is nothing to suggest that the tumor is tuberculous or any other specific process."

It so happened that just at that time an article appeared in the [illegible] Surgery by Dr. A. Murat Willis of Richmond, Virginia, a which he described a tumor of the bowel unique in his experience and unique so far as he could determine in the literature. The photographs that accompanied the article were exact duplicates of the appearance presented by our tumor in the abdomen and afterward on being split open. The consistency of the tumor before the mass was excised was rather doughy.

PERSISTENT CORPUS LUTEUM CYST CAUSE OF HYPERTROPHY OF LINING OF UTERUS

Dr. A. H. Curtis: A woman of 36 who had three healthy children had been bleeding for a period of two or three years to such an extent that she was transfused at Minneapolis last fall. At one time her hæmoglobin went down to 25 per cent. There had been a previous operation at which time the right ovary was removed. She had a miscarriage in December and because of persisten bleeding we curetted, thinking there might be some retained decidual material. Dr. LeCount decided there was danger of a chorio-epithelioma and advised that we perform a hysterectomy to be certain that she have no future trouble. On opening the abdomen I found the remaining ovary, which contained a corpus luteum cyst. The fundus of the uterus when removed was full of very foul, bloody material and on microscopic examination we found an enormously hypertrophied endometrium. Instead of the usual glandular enlargement associated with ordinary bleeding or with the changes we find at the time of menstruation, we found that the glands had grown in a manner that simulated adenocarcinoma and that the endometrium was five or six times as thick as normal. The case is of interest chiefly because there was only one ovary which contained a persistent corpus luteum cyst. This suggests that persistent corpus luteum cysts are responsible for hypertrophy of the lining of the uterus.

Dr. Ries asked me a question about 4 years ago that I would like to answer now. It is in regard to the cyclic changes in the endometrium which were reported by Hitschmann and Adler. They believe that the endometrium follows a very well marked rule, that you can diagnose the resting stage, the premenstrual stage, and the menstrual state, and that which follows menstruation. He asked whether we have found great variation from this typical classification. This particular specimen which I spoke of, which has a cyst of the ovary associated with a very great development of the endometrium, with a cyst-like formation in the endometrium is typical of a very large number of instances which I have seen. I believe we have a great number of changes in the endometrium which are deviations from normal and which escape our attempts at classification.

DISCUSSION

Dr. Emil Ries: At the meeting of the American Medical Association in Atlantic City some 4 or 5 years ago I read a paper on alternating periodic ovarian tumors. These corpus luteum cysts have a great deal to do with irregular endometria. According to the paper we heard some time ago from Dr. Heaney on corpus luteum in animals, its influence on sterility is well recognized by veterinarians. I have seen ovarian cysts which give every symptom of extra-uterine pregnancies. The history is that menstruation has been delayed a week or two, then the patient starts to bleed. If operation is performed nothing but a corpus luteum cyst is found. On the other hand, patients come to the hospital because menstruation is delayed. A cyst on one side is found. You do not know whether it is a corpus luteum cyst or not but it breaks under your finger and the next day the patient menstruates. In such cases there is disturbed function of the endometrium.

Dr. N. S. Heaney: The persistent corpus luteum in animals is a solid body. The corpus luteum that Dr. Ries mentions as so often confused with ectopic pregnancy is a cystic body. About three weeks ago I operated upon the only case of a solid corpus luteum which I have thus far found in the human family. This patient came to me on account of hæmorrhages from a fibroid uterus and I found a solid body about an inch in diameter in the left ovary. I saw her 6 weeks later and the body was still there and in consequence I thought I was dealing with a fibroma of the ovary. Subsequently I did a vaginal hysterectomy. The body in the left ovary proved to be a solid corpus luteum. It was pedunculated and helled out of its little pod exactly as does the persistent corpus luteum in cows.

Dr. Curtis: How did you know that it was a persistent corpus luteum?

Dr. Heaney: It was there at two examinations, 6 weeks apart.

PROLAPSE OF THE RECTUM

Dr. Thomas J. Watkins: Miss E. W., age, 26; weight, 130; has always been well until recently except for minor illnesses. She had an extensive Whitehead operation in May, 1921, for large hæmorrhoids, complicated by some prolapse of the rectum. In September, 1921, she was referred to me for operation for rectal prolapse. Two or three inches of the rectum was prolapsed; no hæmorrhoids. The perineum was so much relaxed and stretched that it had the appearance of a perineum of pregnancy with the fœtal head presenting at the vaginal orifice. She was greatly disturbed when up and about and was obliged to remain in bed much of the time.

Operation. The operation consisted chiefly in repair of the levator ani muscle and its associated fascia. The posterior vaginal wall was incised from the cervix to the cutaneous surface down to the rectum. The peri-rectal fascia and levator ani muscle were sutured from the cervix downward to the skin surface, the sutures passing into the rectal wall so as to retract and fix it; a few linen sutures were used for the purpose of producing and stimulating an increased amount of scar tissue. The other sutures were catgut. After repair of the levator ani along the rectal plane, the muscle was exposed by incision along the pubic rami by lateral incisions and was repaired by the usual operation of perineorrhaphy. The prospects for a good result seemed excellent but she returned 1 month later with some rectal prolapse, but with a firm perineum. A small plastic operation on the rectal wall resulted in a cure.

The case was a congenital defective levator ani which became excessively relaxed, following the development of large hæmorrhoids.

Rectal prolapse is a hernia and results from a defective levator ani muscle. We believe that repair of the levator ani muscle along the rectal plane the entire length of the posterior vaginal wall, incorporating the rectal wall, is a valuable adjunct in the treatment of prolapse of the rectum.

DISCUSSION

Dr. Vernon C. David: The etiology of prolapse of the rectum is not entirely clear. Perhaps the most outstanding fact is its frequent occurrence in infancy and childhood. Napalhow's statistics show over 60 per cent of the cases were in children between 1 and 3 years of age. Waldeyers' post mortem study of the pelvis in a number of children who had a prolapse of the rectum brought out the fact that the anterior concavity of the sacrum was much diminished so that the ampulla of the rectum no longer settled into it on any increase of intra abdominal pressure but was pushed downward. Zuckerhandl observed that the cul-de-sac of Douglas was deeper in embryonal life and early infancy, reaching to the lower border of the prostate in contradistinction to its usual position at the level of the seminal vesicles in adult life. In addition to these factors the marked relaxation of the levator ani, sphincters, and rectoperineal and rectococcygeal muscles in cases of rectal prolapse is well known. That any one of these factors is the deciding one in the causation of the conditions is doubtful. Jeannel and Verneuils have called attention to the rarity of rectal prolapse after traumatism or destruction of the sphincter ani muscles as, for example, after fistula *in ano* operation or in perineal lacerations. Lenormant destroyed the levator ani muscles in dogs and forcibly produced a prolapse of the rectum. This replaced itself and did not recur.

As to general factors it seems to me that prolapse of the rectum usually is seen in individuals suffering with tabes or other conditions where the general muscular tone is weak and atrophic. Long standing diarrhœa and factors causing increased intra-abdominal pressure play the principal rôle.

In the treatment of prolapse of the rectum the multiplicity of ways and means stamp the efficacy of the procedures with doubt. Many and varied operations and methods have been proposed. Of them all I regard as best the operation described independently by Rehn and Delorme about 20 years ago. This consists in a circular incision through the mucosa at the mucocutaneous line in the rectum, and a denudation of the entire prolapsing segment of its mucous membrane. The muscularis of the prolapsed bowel is now reefed longitudinally by catgut stitches which when tied collapse the prolapsed segment much like an accordion when it is closed together. This places the rectal muscularis inside of the sphincters, which are now narrowed by mattress stitches. Finally, after cutting off the excess mucosa it is sutured back to the skin. This operation [illegible] addition of [illegible] rhage. The principles underlying the operation are those of obliteration of the prolapse, plication of the sphincters and use of the puckered muscularis of the prolapse as a p[illegible] prevent recurrence.

Dr. [illegible] Dr. David described very clearly the etiol[illegible] treatment of recta[illegible] mucous membrane and puckered the muscularis, as he described, in conjunction with th[illegible] upon the levator ani, the second operation probably would not have been [illegible] his remarks relative to the deep cul-de-sac of Douglas in such cases.

PELVIC MEASUREMENTS BY X-RAY

Dr. Alfred Baker Spalding, [illegible] California, read a paper on "Pelvic Measurements by X Ray" [illegible].

DISCUSSION

Dr. David A. Horner: There are some things about this method which make me rather doubtful of its value even though I was formerly enthusiastic about it.

Localization of points for all transverse measurements is easy in clear roentgenographs, but such very important points as the promontory and the poste or surface of the pubis are very difficult to locate exactly even with the stereoscope.

If you ask a dozen people to identify the actual point called the promontory, the variations may be from 1 to 3 centimeters. Similar difficulties exist in localizing the desired point behind the pubis. These differences seriously affect the calculations. What is the conjugata vera? It is the available diameter between the promontory and that part of the symphysis which projects into the pelvic cavity. The pubic end of the conjugate is really cartilage and does not show on plates. Dr. Spalding points to the top of the symphysis, which to my mind is faulty. Anteroposterior views for sagittal measurements allow too many possibilities of error. Lateral pelvic views would be more accurate. Our [illegible] the various internal pelvimeters are not always reliable.

Dr. Alfred Baker Spalding (closing the discussion): I would like to say that Dr. Harris of New Haven, has a method whereby he can very accurately measure the rim of the pelvis. I think the roentgenologists are helping us to secure accurate pelvic measurements but I believe the obstetricians must co-operate with the roentgenologists just as the surgeon co-operates with the roentgenologist. At Stanford we are working on a method of cephalometry that I believe is going to give accurate results.

AMERICAN COLLEGE OF SURGEONS

THE PRESIDENT'S ADDRESS, AMERICAN COLLEGE OF SURGEONS[1]

By JOHN B. DEAVER, M.D., F.A.C.S., Philadelphia

WE have gathered here in this historic city at this time with the prospect of reaping goodly harvest of knowledge through the exchange of professional experiences and in the delights of pleasant social intercourse. Men have come from far and near to honor our meetings with their presence and by their presence to emphasize anew that science knows no boundaries, and that the American College of Surgeons, though national in name is international in scope.

Before slipping away into "well deserved obscurity," to use the words of your genial Director General, which he evidently thinks will be my lot after relinquishing the high office with which you have honored me, I want to express to the Director General himself, and to my associates in office, my deep appreciation of their co-operation and support in the performance of my presidential duties. That they have not weighed more heavily upon me than they have is entirely due to their kind consideration.

As the swift hands of time complete the circle of another twelve months in the annals of the American College of Surgeons, we find its activities increasing and its influence enjoying an ever-widening arena of usefulness. The reports of the various sections will give in detail the result of the work accomplished during the year. From a general survey of the work, we can gather the gratifying knowledge that our efforts have not been limited to the improvement of our immediate professional demands, but, that the College is carrying on the basic principles of the profession—for the good of humanity. The work of health propaganda has been extended over a larger number of communities than ever before. It has been my privilege to attend a number of the sectional meetings of the College held in various parts of the country. The fatigue of long journeys and the interruption to the regular routine of professional work have been more than compensated for by the hearty reception accorded me by my professional brethren and by the enthusiastic appreciation of the laity of our endeavors to put before them in simple terms some of the important aspects of things pertaining to public health and the prevention of disease. Without vain and pompous self-glorification, I believe that we here in America are pioneers in carrying directly to the people this vital message of improvement in the health of the race. We cannot help believing that the future is big with promise of the results of this phase of the activities of the College. The poet has said, Art is long and Time is fleeting, but he might well have included Science in his dictum. In the world of science and particularly in the realms of medicine and surgery, while alas, we sometimes too soon get the immediate results of our efforts, more often we have to wait in silence and in patience for the evidence of the beneficial results of our work. How often do we fondly think we have been successful when lo, we are confronted with disappointment. We have to wait at least five years before we can claim an actual cure for our cancer cases. All of us have seen a recrudescence of trouble in the region of the gall bladder after five, seven, and even ten years of apparent freedom from symptoms. In our experimental and research work, Science demands years of labor and patient waiting before the research worker dares to announce a triumphant result. No one better than we surgeons are aware of how limited we are in the midst of our tremendous forward strides in methods and technique. But whatever may be our shortcomings with regard to individual results, in the long run the work of the American College of Surgeons along the line of improved standards in surgery, in hospital management and in public health, must and will be productive of results, and today we may indeed harbor the assurance, that we are preparing a rich heritage for those who are to come after us.

It is in turn this consciousness that must inspire us to continue unabated our efforts along the lines so auspiciously inaugurated.

It was but natural that hospital standardization should develop as an important adjunct to the original purpose of the College—the betterment of surgery in this country. We cannot ex-

[1] Boston, October 23, 1922

pect good surgery to emanate from poor surroundings. It is this part of our program also that is attracting the attention of the public at large. It is affecting the laity through the hospital Board of Trustees not all of whom, however, I am sorry to say, as yet realize the importance of scientific standards. Nevertheless, through the hospital boards to a great extent the message of improvement is being broad-cast. It is only natural that the more intelligent class of patients will always prefer the institution that conforms to the requirements of the College standards. It will not take long for other institutions to recognize this fact and to endeavor to work up to at least the minimum requirements which are necessary to be placed on the list of approved hospitals. In time, those institutions that cannot meet this test, let us hope will be eliminated.

But no matter how good the equipment or how perfect the organization, we cannot expect good surgery, except in the hands of good surgeons. Good surgery today means manual dexterity combined with critical acumen; quick decision combined with deliberate manipulation; keen observation combined with logical deduction; singleness of purpose combined with multiplicity of aims; and finally the enthusiasm of youth preserved undiminished throughout the years of work and worry.

These are the foundation stones upon which the American College of Surgeons is endeavoring to rear its super-structure. The international scope of our organization is attested by the presence of distinguished visitors from territories beyond the confines of these United States. That science recognizes no geographical boundaries likewise is attested by the national and international fame of him whom you have selected next to wear the mantle significant of the highest honor in the gift of the College. The president elect combines in his person the essentials of a good surgeon, and the sum and substance of our professional ideals, integrity coupled with originality, and the gift of imparting his vast knowledge to others.

The accomplished specialist, master in his chosen field, and at the same time the erudite scholar with that wide vision which only "an intimate acquaintance with the best that has been thought and said can confer." It is my privilege and very great pleasure to present to you your President-elect, Dr. Harvey Cushing.

ONTARIO SECTIONAL MEETING OF THE CLINICAL CONGRESS

THE Ontario Sectional Meeting of the American College of Surgeons was held in London, Ontario, on October 16 and 17.

The Hospital Conference was conducted in the auditorium of the Western University Medical School. The hall was packed beyond capacity with an audience representing hospitals in all parts of the Province of Ontario. Dr. George McNeill, chairman of the Executive Committee for the Province, presided. The program of this meeting was as follows:

Hospital Program of the American College of Surgeons
.....Franklin H. Martin, M.D., Director General
Hospital Standardization:
Surgeon's Standpoint
George W. Crile, M.D., Cleveland
Community Standpoint..D. A. Craig, M.D., Halifax
Standpoint of a Hospital Owner
.....George A. Ramsey, M.D, London
Hospital Superintendent's Standpoint.....
....R. Kingswood, M.D., Victoria Hospital, London
The Need of Hospital Standardization
Reverend C. B. Moulinier, S.J., President, Catholic Hospital Association
Hospital Standardization and the Ontario Medical Association
T. C. Routley, M.D., Secretary, Ontario Medical Association
Hospital Standardization in Canada.....
.....Malcolm T. MacEachern, M.D
Round Table discussion conducted by Malcolm T. MacEachern, M.D.

The Public Meeting was held in the Majestic Theater on Monday night. Long before the time for the program to begin, the theater was filled to the doors and some six or seven hundred people were unable to gain admission.

Address of Welcome.....
.....Mayor J. C. Wilson, M.D., London, Ontario
The American College of Surgeons—Scientific Medicine and the Public.....
.....Franklin H. Martin, C.M.G., M.D.
What Can Be Accomplished by Routine Prenatal Care
.....John Osborn Polak, M.D., Brooklyn, N. Y.
The Ontario Medical Association and Hospital Standardization
E. R. Secord, M.D., President, Ontario Medical Association
Hospital Standardization in Canada.....
M. T. MacEachern, M.D., President, American Hospital Association
Experimental Medicine.....
.....George W. Crile, M.D., Cleveland, Ohio
Better Hospitals.....
Rev. C. B. Moulinier, S.J., President, Catholic Hospital Association
Modern Public Health.....
D. A. Craig, M.D., Halifax, Nova Scotia

Due to the energetic efforts of the local committee, this was one of the largest and most enthusiastic public meetings the College has ever held.

On Tuesday morning, clinics were conducted at the Victoria and St. Joseph's Hospitals.

A. Primrose, M.D., Victoria Hospital Operating Room
.....Diseases of Breast
H. A. Bruce, M.D., Victoria Hospital Wards .....
Diseases of Gastro-Intestinal Tract
Hadley Williams, M.D., Victoria Hospital Operating Room.....Prostate, Bladder, Nerve, and Bone Cases
E. Seaborn, M.D., and E. Hodgins, M.D., St. Joseph's Hospital
.....Cystoscopic Clinic, Genito-Urinary Diagnosis
Septimus Thompson, M.D., Victoria Hospital Eye Operating Room.....Eye, Nose, and Throat Cases

The Scientific Meeting held at the Western University Medical School at 2:00 p.m. of the second day was crowded beyond capacity.

The Bad Risk Patient.....
.....George W. Crile, M.D., Cleveland, Ohio
Dry Labor, Its Present Day Management by the General Practitioner (illustrated).....
....John Osborn Polak, M.D., Brooklyn, New York

A very excellent medical clinic was conducted by Dr. Leonard Rowntree, of Rochester, Minnesota, under the auspices of the Western Ontario Academy of Medicine.

At a meeting of the Fellows of the College it was decided to hold the next Ontario Sectional Meeting in Ottawa. The Ontario Executive Committee for the coming year is as follows:

Chairman: Dr. A. T. Shillington, Ottawa.
Secretary: Dr. George A. Ramsey, London.
Counsellor: Dr. L. F. Robertson, Stratford.

The new War Memorial Hospital for Children, attracted a great deal of attention. Lunches were provided by the ladies at the Memorial Hospital for those attending the meetings. The exhibits of work from the various hospitals in and about the city of London and the Queen Alexandra Sanatorium were very commendable and attracted much interest. The interest in this Sectional Meeting shown by the lay organizations, the churches, fraternal societies, and the press was exceedingly gratifying and contributed largely to the success of the meetings.

The Director General and Dr. MacEachern addressed the Rotary Club at their midday luncheon on Monday, October 16, and were given an enthusiastic hearing. Nowhere has there been greater enthusiasm in the movement for better health and better hospitals and in the American College of Surgeons than was found at the London meeting.

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